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Night Photography by Electric Light.

The Journal of Electricity

AN ILLUSTRATED REVIEW OF THE INDUSTRIAL APPLICATIONS OF ELECTRICITY, GAS AND POWER.

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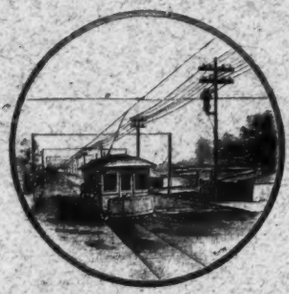

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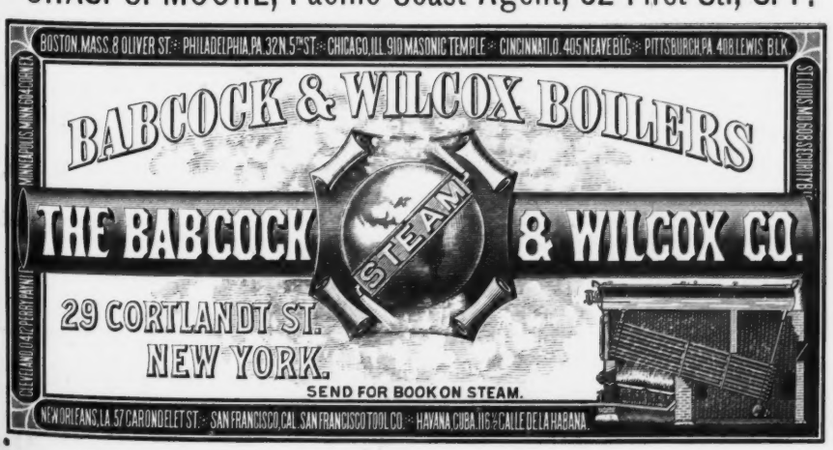
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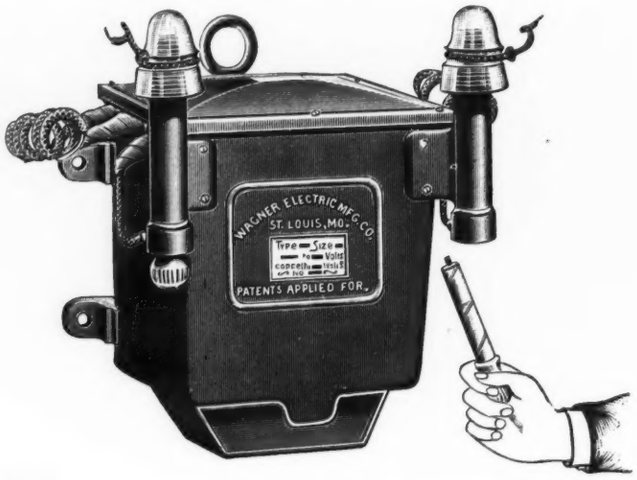

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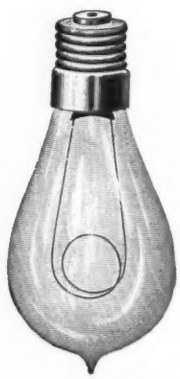

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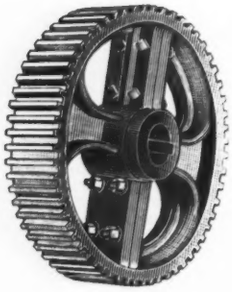

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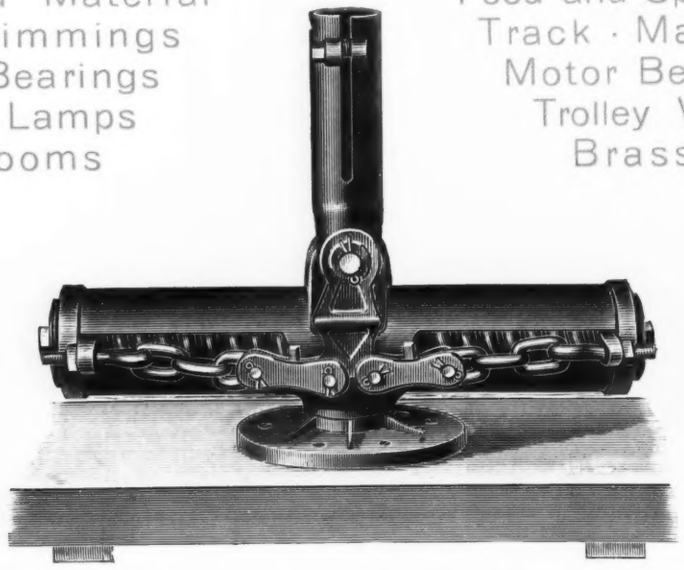

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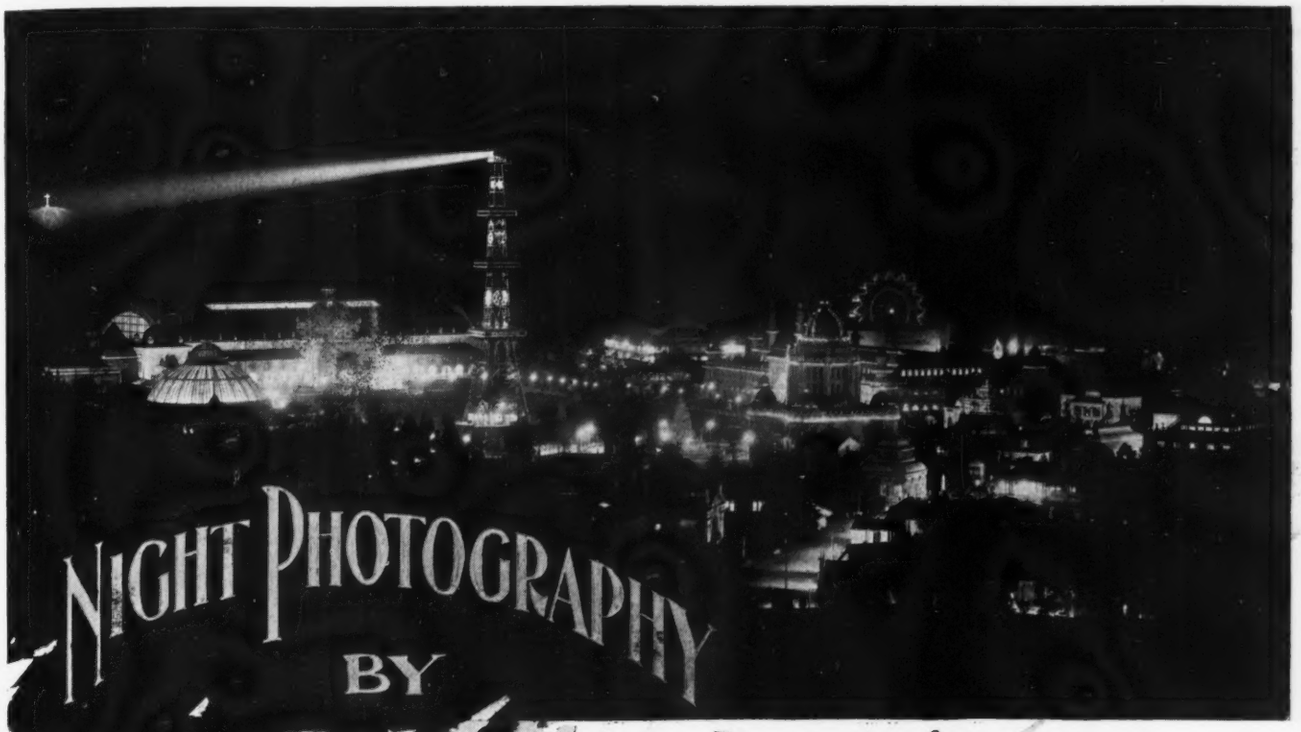

NIGHT PHOTOGRAPHY BY ELECTRIC LIGHT

By Jos. F. Mullander and Sidney Sprout.

AN EDITORIAL which appeared in a recent number of the Journal of Electricity complained that without doubt the thousands of spectators who found much to admire in the elaborate display of lighting effects witnessed during the Electrical Carnival Night pageant at Sacramento, would regret to learn that "despite the efforts of several local photographers, there is not to be obtained a single illustration of even a single float that would make a creditable appearance, or that is worthy of reproduction."

This is a situation that excites but little surprise in view of the paucity of information concerning the taking of night photographs by aid of the electric light, and it does not follow that the inability of a photographer to picture night effects is a reflection against his professional ability for many reasons, foremost among which is, of course, the necessity for experience in this work, and, above all, a perfect co-operation of effort between the photographer and the electrician. It is the purpose of this article to give, as far as is possible, such details of practical experience as will enable work of the character defined to be undertaken intelligently by any pains-taking photographer; but success cannot be attained, nor can the results herein portrayed be accomplished, without perfect unanimity and accord of action on the part of both the photographic and electrical interests.

It is a matter well known in photographic circles that night photography did not become an established art, so far as the perfect delineation of high lights and obscure details are concerned, until the spring of 1894, when the night photographs of scenes of the California Midwinter International Exposition were taken by I. W. Taber, the San Francisco photographer, and it was at the hands of the writers of this article — one of whom is the chief view artist of the photographer named, the other being the Assistant Electrical Engineer of the Midwinter Exposition, that the results herein given were accomplished.

The idea of making exhaustive researches in the

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sphere of night photography by electric light was due to the desire of the Manager of the San Francisco Examiner to develop a new and striking feature in the way of illustrating the portfolio of views of the Midwinter Fair that was then under preparation by that paper. The first efforts made in the way of night photography were far from satisfactory, as has been the experience of every photographer that has ever attempted work of this nature, and the discouraging results may be summed up in the statement that the high lights caused halation of the plate to such an extent that all detail was lost. Composite photographs taken instantaneously by daylight, but with under exposure, and then exposed again by night from the same sitting, were then experimented on with no better success, and the photographs thus derived, one of which is shown in Figure 4, bore the unmistakable marks of "faking." In this photograph an instantaneous exposure was made about 5 o'clock in the afternoon, when the camera was left standing until 9 o'clock P. M., and then exposed for the illuminated effects for 15 minutes. No assistance was rendered in the electrical department in the way of turning off lamps or regulating the direction of the search light, but as the latter would form an indispensable feature in any night photograph of the Court of Honor, the beam of the search light was "faked" on to the negative by means familiar to every photographer. The general aspect of the photograph is one of twilight, just after the starting up of the lighting circuit, but the knowledge that prints from this plate were not genuine, and the firm determination to secure bona fide photographs that would be absolutely free from fraud of any kind, led to the suppression of the prints, and none were ever distributed.

It soon became evident that original research alone could solve the problem, and an analysis of the situation led to the conclusion that it would be necessary to so time the various features of the subject that all details would be given equal exposures, or, in other words, that the features of the subject should be graduated into lights and shades, varying from high lights to obscure details, and that different periods of exposure should be made for each such feature, so that the effect on the plate would be the same as though all features were lighted in perfect equality. It was at this point that the services of the Electrical Engineering Department were brought into demand, and work was commenced on a basis that is believed to have been new and entirely original. All photographs of the Midwinter Fair were taken on Seed plates No. 26, that varied in size from 8 x 10 inches to 18 x 22 inches. No non-halation plates were used, except experimentally, as it was found that ordinary single coated plates are far superior to the non-halation plates, for the reason that the latter will not bring out details to a satisfactory degree. Both wide angle and rectilinear lenses, as will appear, were used, and throughout all the work, almost without exception, the camera was operated with an F16 stop.

The successful development of plates of night photo-

FIGURE 1—A VIEW OF THE TOWER FROM THE MAIN ARCH OF THE AGRICULTURAL BUILDING, MIDWINTER FAIR, ILLUSTRATING THE IMPRACTICABILITY OF PHOTOGRAPHING A BEAM OF LIGHT WITH A WIDE ANGLE LENS. (Copyright 1894, by I. W. Taber.)

graphs can only be accomplished through the careful use of a solution of red prussiate of potash to reduce the halation wherever necessary. This solution consists of the following ingredients: Red prussiate of potash, ½ ounce; hypo, 2 ounces; water, 16 ounces. The action of this solution is analogous to that of planing a board, and if it is flooded over an entire plate it will reduce the film proportionately. To check halation it is applied to the parts affected with a bit of cotton, which cuts away the high lights of the film, and when these high lights have been reduced sufficiently, further reduction must be checked by putting the plate to wash in water. Halation may often be checked if not prevented while developing the plate by application of a solution of bromide of potassium, consisting of one part of bromide to 10 parts of water. When it is noticed that certain lights are coming up too sharply on the plate, the touching of these parts by a bit of cotton wet with the bromide solution will check the development. An illustration of the effectiveness of this may be seen in the photograph from which the illuminated caption at the head of this article was taken, in which the lights from the interior of the Vienna Prater were coming up so strongly as to lose all details of the building, but through the prompt use of the bromide solution the development of the high lights was checked with the satisfactory results shown.

In photographing high lights the tendency is to turn the film into a perfectly hard, black substance, from the excess of light, just as nitrate of silver, when exposed to the sun, will turn black. Under proper exposure the film should turn only to a gray color, but with over-exposure the high lights spread, increasing in size with the increased length of exposure, forming halation that becomes impossible to reduce. With arc lamps the rays are sometimes so intense as to actually burn holes through the films, possibly owing to the focusing of its heat-rays, as in a sun-glass, and to treat such troubles is manifestly impossible, as there is no film to be affected. An occurrence of this nature is shown very prettily in the view of the State Capitol Building, as illuminated on the 9th of September last, which is reproduced in Figs. 6 and 7, from a photograph taken by Mr. A. Peterson. In this a Seed 27 plate was used, and the first illustration shown was printed from the plate as it appeared after ordinary developing, and the second illustration is from the same plate, after having been treated with red prussiate of potash for the purpose of cutting down the high lights. The exposure was of 2½ minutes' duration, which resulted in a severe burning of the plate about the arc lights in the dome, but it is evident that this has been very successfully reduced, except at the point of focus of the heat-rays of the arc-lamps, which, as stated, have burned holes through the films. It would be difficult to obtain a more satisfactory photograph without the assistance of the electrician controlling the lights.

FIGURE 2—THE LIBERAL ARTS BUILDING, ELECTRIC FOUNTAIN AND DOME OF THE AGRICULTURAL BUILDING, MIDWINTER FAIR. (Copyright 1894, by I. W. Taber.)

An illustration showing forcibly the futility of endeavoring to accomplish night photography without the assistance of the proper parties controlling the lighting effects is given in Figure 12, which is a reproduction from a photograph taken of an illuminated arch thrown across Market street, San Francisco, last Fourth of July. In this instance an exposure of 20 minutes was made

with the stop wide open, and the plate was not treated in any way. The lamps upon the arch were of different colors, which explains the varying degree of brightness. The street traffic was perhaps larger than is usual on evenings, but of course does not appear distinctly on the photograph, even though a 26 plate was used. The streaks running along in the center of the street are from the signal lights of the passing cars, while the bright, continuous streaks are from the headlights of passing cars. These, of course, could have been prevented by capping the camera during the passing of each car, but it was deemed advisable, for the sake of illustration, not to interfere with the continuous exposure.

A similar experiment in night photography is given in Figure 11, showing a canopy of incandescent light operated during the recent water carnival at Santa Cruz, Cal., together with fire works. This exposure was started at 9:30 P. M. and stopped at 9:50 o'clock, when all incandescent lamps were turned off, but later in the evening the camera was uncapped and exposed for 30 minutes during a display of fire works. The halation appearing was caused by the calcium lights being turned directly upon the camera, and no efforts were made to remove the rings thus formed.

Reverting to the Midwinter Fair, in order that the proper exposure may be given to bring out each feature of every subject, regardless of whether such feature consisted of high or low lights, the plan was adopted of issuing orders to the dynamo room to start up or shut down specified exterior lighting circuits at such times during the evening as had been predetermined. The services of the electrical department thus became indispensable, and the first view taken after these were secured is reproduced in Figure 3, showing the Administration and Agricultural Buildings, and with the search light on the Observatory on Strawberry Hill. In addition to the usual lights, the buildings and the tower were illuminated for five minutes each by the small search light placed in the turret of the Mechanical Arts Building. The time of exposure was as follows: 9 P. M., exposure began; 9:01 P. M., arc lamps shut off; 9:15 P. M., tower lights shut off; 9:30 P. M., camera capped — giving a full exposure of 30 minutes for the buildings, incandescent and search lights.

The night view of the Liberal Arts Building, shown in Figure 2, was taken with the following exposures:

FIGURE 3—THE COURT OF HONOR AND THE ADMINISTRATION AND AGRICULTURAL BUILDINGS OF THE MIDWINTER FAIR, WITH SEARCH LIGHT THROWN UPON THE OBSERVATORY ON STRAWBERRY HILL. (Copyright 1894, by I. W. Taber.)

The building and decorative incandescent lamps, one hour; search light on the building, fifteen minutes; electric fountain, five minutes; arc lamps, one minute.

In rather painful contrast to this illustration is that presented in Figure 5, which is a reproduction from an amateur effort of night photography with the same subject. This merits criticism from many points, but clearly all detail was under exposed, while the high lights were over exposed. Again, it is evident from examination of the lower right hand corner of the photograph that the developer was not flowed evenly over the plate, and that the portion of the plate which evidently was omitted from the initial flow shows better detail than the main portion of the plate. This, in turn, indicates over-development — as over-development always brings out halation it makes the hard lights harder. The severe

burning given the plates by the arc lamps has caused such halation that no reduction could have saved them.

Here may be mentioned the fact that a peculiarity of negatives produced in photographing arc lamps are the bright rays or streaks of light emanating therefrom, and

FIGURE 4—A COMPOSITE DAY AND NIGHT PHOTOGRAPH OF THE SUBJECT PRESENTED IN FIGURE 3.—A suppressed "fake l" photograph. (Copyright 1894, by I. W. Taber.)

which are always of the same inclination. No satisfactory explanation of these rays has been advanced, but the writers believe that inasmuch as the camera will reproduce details that the eye cannot detect, these rays have an actual existence but are not sensible to the human eye. By treatment of the plate they may be considerably reduced, but not eliminated, provided the plate is not too far over-exposed.

The first night photograph taken was that reproduced in Figure 8, the subject being the Tower, the Court and the Manufacturers' Buildings, which was given an exposure of thirty minutes under ordinary conditions — that is, with all lights, both arc and incandescent, operating as usual and the search light playing in all directions. In this connection it may be well to state that the favorite subjects illuminated by the search light were the simple cross on Lone Mountain, the Prayer-book Cross, and the Observatory on the top of Strawberry Hill. In this instance, the Cross on Lone Mountain formed the subject most appropriate to the photograph, and fortunately it suited the humor of the man controlling the search light to illuminate this cross more than the other subjects. Upon developing the negative, however, rays of light extended in all directions, but these, with the exception of one ray in the direction of Strawberry Hill, which the photograph shows faintly, were cut down in the manner hereafter described.

It is clear from an analysis of the photograph, if not of the illustration, that the high lights were so strong that all of the fine detail of the buildings and grounds were practically lost, as were also all of the geometrical forms which were outlined in incandescent lamps on the tower. To have made the exposure proper to avoid halation would have been to lose all of the details about the buildings, and conversely, in order to bring out the details in the buildings and grounds, halation resulted, as is evident.

The beauty of the view presented in Figure 1, showing the tower from within the main arch of the Agricultural Building, was noted towards the close of the Fair, and several attempts were made to photograph it, but none of which, even the one here reproduced, was perfectly satisfactory. The conditions presented were trying in that the subject contained objects both near and distant, which afforded considerable difficulty in focusing, and necessitated the use of a wide angle lens. This alone would not have been a material difficulty were it not for the fact that we have thus far found it impossible to photograph the beam of a search light when using a wide angle lens, the reason probably being that the rays are so diffused as to dissipate their actinic effects. The night on which this photograph was taken was exceptionally favorable in that the atmosphere was sufficiently hazy to bring out the beam of the search light very strongly, but despite this it was but faintly brought out in the photograph. The interior of the arch was illuminated by two arc lamps, and the times of exposure are as follows: 9 P. M., camera uncapped; 9:10 P. M., arc lamps extinguished; 9:15 P. M., the arch arc lamps extinguished; 9:30 P. M., tower "blinkers" extinguished; 10 P. M., tower incandescents extinguished; 10:30 P. M., camera capped, after giving the beam of the search light an exposure of one and a half hours. No more striking example of the inability of a wide angle lens to photograph a beam of light can be given than that shown by comparison of Figures 1 and 3. The photograph from which Figure 3 is reproduced, and which was taken with a rectilinear lens, was exposed thirty minutes, while

FIGURE 5—THE LIBERAL ARTS BUILDING AND ELECTRIC FOUNTAIN UNDER ORDINARY EXPOSURE, ILLUSTRATING THE BEARING OF OVER-DEVELOPMENT UPON HALATION. (Copyright 1894, by J. N. and D. Creighton.)

the photograph shown in Figure 1, taken with a wide angle lens with a superior beam of light, was exposed for one and a half hours.

The superb photograph from which the caption of this article was made, and which shows a general night view

of the Midwinter Fair grounds, was taken from Strawberry Hill, the exposure being started at 9 P. M. From previous observations it has been found that a considerable portion of the Fair grounds, particularly that of the Midway nearest Strawberry Hill, would appear as excessively lighted or not lighted at all, according to whether the lights therein were turned on or off. In the former instance halation would not only destroy all detail, but would ruin the photograph, and as the bringing out of this portion of the Fair grounds was desirable,

FIGURE 6—THE ILLUMINATION OF THE STATE CAPITOL BUILDING AT SACRAMENTO, REPRODUCING A PRINT MADE FROM A PLATE BEFORE THE REDUCTION OF HIGH LIGHTS AND HALATION.

the arc lamps lighting it were shaded from the camera by means of pieces of card board attached to the lamps on the sides nearest the camera so as to obscure all the direct rays of light. These lamps were left burning throughout the entire exposure with the result that the thoroughfares and buildings, being well illuminated, are excellently reproduced. As stated, the exposure started at 9 P. M., and at 9:05 all arc lamps around the Court were turned off. The "blinkers," as the changeable lights in the tower were termed, were run until 9:30, but the buildings and incandescents, together with the search light and Firth wheel, which were kept stationary, were allowed to run until 10 o'clock, when the camera was capped. The electric fountain was played nightly for twenty minutes from 10 o'clock, and on this particular evening it had been arranged that at the close of its play all jets of the fountain would be operated under white light for five minutes additional, during which the camera was uncapped. It may be noted that the plate from which this photograph was taken was not treated in any way except by the application of red prussiate of potash, and that the night was windy and generally disagreeable.

An excellent specimen of night photography was secured recently at Glen Una, the home and prune ranch of Mr. Frank Hume near Los Gatos, Cal., and which is shown in Figure 9. The subject is situated in the midst of a grove of scrub oaks, which being very thick, and it being 10 o'clock at night, rendered the subject very dark. The exposure was commenced at 10 P. M., and stopped at 10:30, the only light being that of a single 2000 candle power arc lamp, and that of incandescent lamps concealed in the Japanese lanterns shown. No people appeared during this exposure, but instead, at its conclusion the people were grouped as shown, and an additional exposure of five minutes was made.

The photograph reproduced in Figure 10 shows the interior of the electric fountain, the striking feature of which is the manner in which the rays of light from the horizontal reflectors were brought out. This was the result of an accident. Several unsuccessful attempts had been made upon this subject, and it was finally concluded to make a time exposure of five minutes, upon the expiration of which time a flash light would be used, but when the cap was removed the flash light was accidently set off, filling the room with smoke which brought out the rays so much stronger that the exposure was continued ten minutes longer in order that the full effect might be secured. The plate was not treated in any way, and the lesson thus learned has since been of service many times in bringing ont lighting effects that would otherwise have been impossible.

Considering the remarkable results that were attained in the way of night photography at the Midwinter Fair, regret will always be felt, perhaps by millions, that similar efforts were not undertaken during the late World's Fair at Chicago, and it is to be hoped that the officials of the Atlanta Exposition now in progress will embrace

FIGURE 7—THE ILLUMINATION OF THE STATE CAPITOL BUILDING AT SACRAMENTO, REPRODUCING A PRINT MADE FROM A PLATE AFTER THE REDUCTION OF HIGH LIGHTS AND HALATION.

the opportunity presented for further research in the realms of night photography.

"AS OTHERS SEE US."

The Electrical Journal changes its name with the September number, the third issue, to The Journal of Electricity. It is one of the best technical papers coming to the reviewer's table, and contains much valuable knowledge for the student as well as the practical electrician. The different departments are well edited, and The Journal under the management of Mr. George P. Low has from the start secured an enviable advertising patronage. The Overland Monthly, San Francisco.

THE MAGNETIC SEPARATION OF FREE GOLD. A SUGGESTION.

By Lieut. W. Stuart-Smith, U. S. N.

The writer was recently consulted regarding the possibility of utilizing electricity for the separation of the free gold from black sand, and, after some thought, conceived the idea of a magnetic separator, similar in principle to those in use for concentrating iron ores. Evidently a direct current cannot be used, since the metal to be separated is not capable of being influenced by constant magnetism.

The gold exists in a free state, consisting of very thin flakes, each of which may be considered as constituting a closed circuit. If, then, the magnets be energized by an alternating current of high frequency, and the sand containing the gold be passed in front of the poles in a thin stream, or be blown against the poles by a gentle air blast, the rapidly changing magnetism will generate in the contained metal currents of considerable magnitude, and the reaction between these and the magnetic field will cause the gold to be separated from the sand.

A small generator only would be required, and if only the larger and heavier particles of gold could be separated, it would seem that the sand could be worked at considerable profit, as the labor expended on the sand itself would be simply that required to shovel it into a hopper.

Figure 8—Night Photography. The Tower, Court and Liberal Arts Building of the Midwinter Fair. (Copyright 1894, by I. W. Taber.)

Figure 9—Night Photography. In the Grove at Glen Una, Time, 10 p. m.

AS OTHERS SEE US.

The Journal of Electricity (September)—The right to priority of claim to the title of The Electrical Journal which was raised by the papers of that name published respectively here and in Chicago, has been settled. Both papers came out at the same time and each claimed the name. The Journal here has at last decided to stop the controversy, and appears under the name of The Journal of Electricity, a name as fitting and in keeping, moreover, with its purposes. It is edited by George P. Low and F. A. C. Perrine, two well-known men in electrical circles. The September number has a prosperous appearance.—Engineer and Contractor, San Francisco.

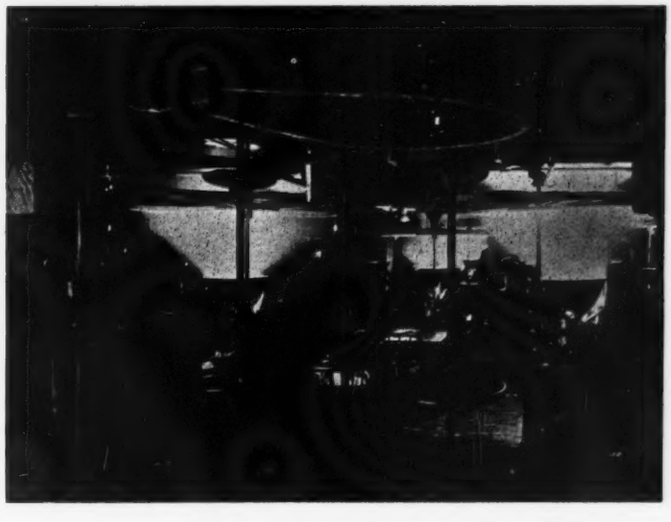


Figure 10—Night Photography. Under the Electric Fountain at the Midwinter Fair.—A suggestion for bringing out light rays. (Copyright 1894, by I. W. Taber.)

DISPENSING WITH MAGNETOS IN TELEPHONE EXCHANGES.

While marvelous advances have been made in developing telephone exchanges to a high standard of excellence, there yet remains details which, though forming indispensable adjuncts, have received but little if any attention, and which stand to-day where they were a decade since. Prominent among these details is the magneto, which, except in the invention of improved features such as gearing so arranged as to automatically cut the magneto circuit in or out, as the case may be upon turning the crank handle, is to all intents the same device as was in use long before the invention of the telephone. It is universally conceded that the magneto itself is not a satisfactory appliance in telephone exchanges, particularly those of large proportions, yet despite this it is used almost exclusively, the only improvement applied being that it is driven by some motive power such as an electric motor. Some exchanges in the large cities are to-day operating dozens of small telephone magnetos which are driven by counter shafting and belting and require much attention.

FIGURE 11—NIGHT PHOTOGRAPHY. THE SANTA CRUZ WATER CARNIVAL, SHOWING HALATION CIRCLES AND FILM BURNINGS. (Copyright 1894, by I. W. Taber.)

For several years the local telephone system connecting various departments of the Edison Light and Power Company of San Francisco, which is operated through a local exchange in the office of the company, was equipped with a single ordinary magneto driven by an electric motor, the latter in turn being operated from the Edison underground circuit. Except for the noise and requiring occasional attention, the service was withal satisfactory, but nevertheless it is believed that it could be improved upon, and accordingly the apparatus shown in the accompanying illustration was installed.

As is evident from the cut, an Edison slow-speed fan motor having a rated capacity of one-twelfth of a horsepower is used, and by placing two collector rings on the other end of the armature shaft from that on which the commutator is located, and by connecting each ring respectively to diametrical points of the armature winding, the motor becomes a motor-generator, transforming the direct current it receives into an alternating current available at the collector rings and of a rate of alternation depending upon the speed of the armature. The electro-motive force of the alternating current is at all times equal to the electro-motive force of the direct current applied to the motor and the rate of alternation is, of course, twice the speed of the armature.

In the present instance, there being no 110-volt motor available, a 25-volt motor was used, and the voltage of the regular incandescent service is cut down to 25 volts by the interposition of incandescent lamps in series with the motor. From the brushes bearing upon the collector rings, leads are taken through a small double pole jaw switch to the primary of the small transformer, clearly shown in the illustration. This primary consists of No. 24 cotton-covered magnet wire, and the secondary winding has three times the length of the same size of wire. The transformer, therefore, builds up the potential from 25 volts to 75 volts, and as the speed of the motor is 1550 revolutions per minute, the rate of alternation is 3100 per minute.

It is found in practice that the ringing of a single 500-ohm bell checks the speed of the motor by about 150 revolutions per minute, while the speed of the motor is checked by about 500 revolutions per minute by throwing a dead short circuit upon the secondary of the transformer. In no other way than by checking the speed of the armature is a load manifested, and obviously under most adverse conditions, *i. e.*, a short circuit, can the conditions imposed be sufficiently severe to cause burning out or other injury. The bells rung from this device are vibrated more strongly than from a magneto.

Under usual conditions a 110-volt motor of the form described or otherwise, as may be desirable, would be used, in which event the transformer would be so wound as to step down from 110 volts to approximately 75 volts, under which conditions the energy consumed running at no load, but exciting the transformer, would be approximately 85 watts, while under full load the consumption will be 150 watts.

FIGURE 12—NIGHT PHOTOGRAPHY. AN ILLUMINATED ARCH UNDER NORMAL EXPOSURE AND ORDINARY DEVELOPMENT.

The entire outfit complete may be erected at slight cost, and will operate from ten to fifteen calls simultaneously with satisfaction. When equipped with self-oiling bearings and with carbon brushes the apparatus runs noiselessly and will not require attention oftener than once a month, if then. The arrangement is due to Mr. F. E. Smith, the chief electrician of the Edison Light and Power Company of San Francisco.

AS OTHERS SEE US.

We have at last received a copy of the first issue of our new contemporary, The Electrical Journal (San Francisco). The venture has received no little attention in the United States, and it is with interest that we turn over its pages. The articles are good.—Electricity, London.

Electro-Insurance.

THE INFLUENCE OF HEAT ON CARRYING CAPACITY.

A fire recently occurred in one of San Francisco's new office buildings, which, though quickly suppressed, caused damage to the amount of about $1000. At first sight it was said that the fire was caused by electric light wires, but after making a thorough examination it was reported that though the conduit tubing and wire insulation was burned away, yet the fire was due to causes other than the electric installation. Nevertheless, the examination disclosed a peculiarly vicious state of affairs in connection with the wiring, which it seems to the writer worth while calling attention to.

The iron columns supporting the floors are cased with closely-fitting tiling, considerable space being enclosed which is valuable as channel ways for wires, pipes, etc. In one of these wires were placed, enclosed in plain interior conduit tubing, and in the same space was placed a steam pipe carrying steam of 100 pounds per gauge. The space was closed, so as to be practically a dead air space, and the temperature must have been closely approximating to that of the steam. Steam of 100 pounds pressure has a temperature of 338° F., and therefore the wires must have had approximately this temperature when no current was passing.

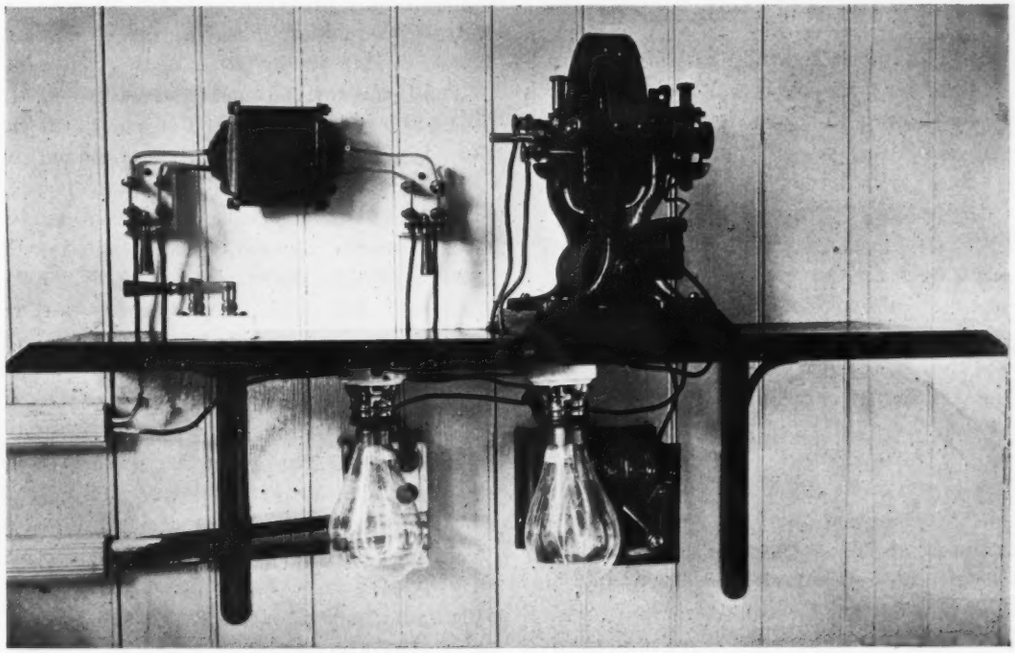
Wires are figured for a safe carrying capacity at 75° F., and for every degree above this the resistance increases .21% of 1. In this case the difference was 263°, or the total increase of resistance was 263 times .21% or 55%. It follows, therefore, that considering only the temperature due to the steam, the carrying capacity was reduced to 45% of the calculated amount, but this represents by no means the actual carrying capacity of the wire. The rules for safe carrying capacity are based upon the possibility of the heat generated being freely radiated, and in this case it is evident that this could not occur owing to the high temperature of the surrounding space. With the reduced conductivity the passage of the calculated safe current would cause a very considerable increase of temperature, which in itself would further lower the conductivity and cause a still further rise of temperature.

It will be seen, therefore, that while a calculation shows that the conductivity could not have been more than 45% of that for which estimate was made, it was in reality less than 45% by an amount that cannot even be guessed at. While it is reported that the electric installation was not the cause of the fire, yet it is readily conceivable that the wire might have been heated to redness. This case shows how thoroughly thoughtlessness may undo intention.

TO REVISE INSURANCE RULES.

The annual meeting of the Electrical Committee of the Underwriters' Electric Association is to be held in New York City during the week beginning December 9th, in view of which it has been deemed wise to adopt some plan by which all interested in the subject of rules for electric light and power wiring, whether members of this Association or not, can have an opportunity to make suggestions for the committee to consider.

It has seemed probable that some points, which might with advantage have been discussed, were lost because there were no written memoranda on the subject to bring the matter to the attention of the committee, and, as a result, forms have been printed for the use of those interested on which may be designated any features of the present requirements which may be deemed objectionable, or which it is believed could be amended, or on which suggestions regarding the formulation of new rules to cover points not now touched upon. These blanks may be obtained upon application to C. M. Goddard, Secretary, 55 Kilby street, Boston, or Geo. P. Low, member of the committee, 303 California street, San Francisco, and must be filled out and mailed to Mr. Goddard on or before December 1st.



Dispensing with Magnetos in Telephone Exchanges.

The Journal of Electricity.

An Illustrated Review of the Industrial Applications of Electricity, Gas and Power

EDITED BY

F. A. C. PERRINE, D. Sc., and GEO. P. LOW.

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EDITORIAL.

AN IDEA FOR BICYCLE BUILDERS.

The importance of a satisfactory headlight for a bicycle is well recognized both by those who have attempted to use any one of the standard headlights, and by those who have been so unfortunate as to encounter a "scorcher" riding at night without a lantern. Most bicyclists prefer to ride entirely without a light for the reason that the lanterns on the market are not capable of giving a sufficient amount of illumination to materially aid the rider in picking his way, though there is no doubt that for pedestrians some visual notice of the coming of so noiseless a vehicle is important.

The photometric tests presented in another column show an extraordinary small amount of candle power of the standard oil lanterns in spite of the fact that the entire light from the flame is concentrated in one direction by means of lenses and reflectors. The burden of the additional weight of a battery for an electric light, which is far more satisfactory, is in general too great to receive unqualified endorsement at the hands of enthusiasts that are constantly striving to attain lighter weight in bicycles.

In casting around for a feasible method for an improved illuminant for bicycle lanterns, one is struck with the fact that for a given amount of weight and bulk there is nothing that will exceed acetylene gas. The tubes of a bicycle frame, which may be readily connected together, contain a volume of about sixty-five cubic inches, and are sufficiently strong to withstand an internal pressure of 2000 pounds per square inch, using a factor of safety of about seven. If an arrangement could be made for charging these tubes with a burning mixture of acetylene and carbon mon-oxide to a pressure not exceeding 600 pounds to the square inch, sufficient gas might be stored to furnish a burner giving about twelve candle power for a period of at least four hours. Burners containing reducing valves for burning the gas under these conditions are on the market, and in use in the Pintsch gas systems which illuminate the standard railway trains. The difficulty of charging is one which might readily be overcome by the establishment of hand pumps in bicycle repair shops, while the burden of weight and expense would not be very much greater than they are at present with coal oil illumination.

CONCERNING THE NEW SACRAMENTO.

Recent information which has just been furnished concerning the capitalization of the various electrical interests of the city of Sacramento has proven the error of surmises lately published in this paper to the effect that unless consolidation or other combination should occur, the city named is on the eve of a struggle of commercial supremacy between its two electric systems. "One side," it was pointed out, "is ranged on the vantage ground of abundant water power, but its forces are crippled because of the heavy interest charges that must be met; the opposing side is free from bonded indebtedness. Its interest charges are light, and by the substitution of gas engines for its present steam plant, and by effecting other changes, it can render service at exceedingly low rates."

The interests referred to are those of the Sacramento Electric Power and Light Company and the Capital Gas Company, respectively, and the publication has brought out new information, from which it appears that the bonded debt of the Capital Gas Company is $150,000 in twenty year 6 per cent. bonds, issued on November 1st, 1890, and that its capital stock is $500,000, in 10,000 shares of $50 each, representing an investment of $650,000. The proportion of this amount that is chargeable to the electric plant may be assumed to be about 50 per cent. approximately per 1000 horse-power. It also appears from statements furnished by the Sacramento Electric Power and Light Company that of the entire bonded issue of the latter company, amounting to $1,500,000, only $300,000 was expended for hydraulic works and exclusive water power privileges. The street railway system of Sacramento, which covers the entire city and which already earns a sum equal to the entire amount of the fixed charges of the Sacramento Electric Power and Light Company, cost $600,000.

Further figures rendered are of interest as showing that the expenditures on account of the present hydraulic and electric generating plant (of 4000 horse-power) together with the transmission line to Sacramento and the new electrical equipment of the sub-station, amounted to $375,000, in addition to which the sum of approximately $125,000 was expended in the construction of the Folsom power house and the Sacramento sub-station. These expenditures make an aggregate issue fo bonds amounting to $1,400,000, leaving a reserve of $100,000 in bonds in the Company's treasury.

Bearing in mind the fact that the revenues of the street railway system, which consumes but about one-fifth of the power output of the present plant, are alone sufficient to defray all fixed charges on the entire transmission and street railway plant, it is evident that the Sacramento Electric Power & Light Company is in a position not only to meet any competition that may arise,

but to furnish power at figures that will seem astonishingly low to Californians. Indeed, the era of cheap power for Sacramento may be said to have opened by the awarding of the contract to the Sacramento Electric Power and Light Company for lighting the streets of the city at a rate one-third lower than had been paid before, but which rate is nevertheless highly profitable to the Company because of its ability to deliver electric power at exceedingly low cost.

ELECTRIC TRACTION FOR COUNTRY ROADS.

The fact that the excellence of the country roads throughout the English agricultural districts has not prevented the farmers from demanding a cheaper method of transportation for the produce than can be obtained by the ordinary means of haulage by teams, indicates that the movement for good roads, which is so universal throughout this country, demands most careful consideration and investigation. The claim is made by those advocating an improvement in the character of the highways that this improvement is demanded by agricultural communities. In England, as has been stated, these communities are at the present time asking for light railways to take the place of team haulage. In this country the movement for good roads has been successful mainly in suburban districts, where their introduction has changed the land from property valuable as agricultural investments to property even more valuable for suburban residences, and when the work which has been actually done in making good roads is examined carefully, it is found that the cases in which progress has been made are very rarely in the midst of an agricultural community. In our last issue we noticed the success attendant upon undertaking the introduction of freight cars on the Oakland and Haywards (Cal.) electric line, and the fact is that these freight cars are being patronized by trucking teamsters, who find it cheaper to load their wagons upon the cars rather than to haul them to the city by teams.

In the State of Ohio a Legislative Commission has reported that the expense of putting the highways in the condition demanded by the advocates of good roads would be nearly if not quite equal to the expense incident to the laying of tram tracks along all of these highways and equipping the greater portion of them with electric power. In a thickly settled suburban district there is no doubt but that the availability of the highways for pleasure driving and bicycling is more important than their adaptability for heavy teaming, but, in localities where the question of haulage is the more important one, we should be very slow in assuming that a greater economy to the community can be obtained by the improvement of the highways as a whole than by any means which would facilitate heavy haulage irrespective of the adaptability to light driving. A roadway 30 or 40 feet wide is unnecessary for the purposes of heavy haulage, all that is required being a solid tread for the wheels of the trucks used, and, if no other motive power is provided, a solid way for the horses.

Such a road as this was constructed long ago over the swampy ground lying between the cities of Albany and Schenectady, in the State of New York, the tread for the wheels being long granite blocks, about fourteen inches wide, between which cobbles were laid for bearing the weight of the horses. Thousands of tons of merchandise have been carried over this road during the past twenty-five years, and a better road or easier haulage would be difficult to find when the purposes for which it was designed are taken into account. Throughout the State of California there are immense quantities of timber, building stone and ore which cannot be worked for a greater portion of the year on account of the impassable condition of the highways, and to bring the roads to such a condition that teaming would be possible throughout all seasons of the year would, in general, cost more to the community than could possibly be afforded. At the same time it would be wrong to say that no endeavor should be made to make these sources of wealth more commonly available. In many such regions the laying of a simple tramway with a tread adapted to wagon wheels would solve the problem, while in some regions, where water power is available, it might be economical to equip the roads with electric power, and should this be done it would not be necessary to utilize any other rolling stock than the ordinary country wagon. We are not aware that this plan has been tried on any established tramway, though the analogous scheme of hauling country wagons by the means of a road engine has been found economical, both throughout the confines of our own State and in many other localities adapted to the use of the steam-road engine.

Advocating this plan may be looking very far into the future, but it certainly seems that, with the general advance in engineering knowledge, we may hope that, in considering the question of the improvement of highways, more of our County Commissioners may consider the economy to be obtained in haulage of produce by laying iron tramways which will be ultimately adaptable to the purposes of electric haulage.

POWER TRANSMISSION BY COMPRESSED AIR.

The importance of compressed air as a means of transmitting power is more readily appreciated on the Pacific Coast, where successful mine plants have been for so many years using air compressors, than in sections of the country where this work is entirely unfamiliar.

Although the transmission of power by the means of water at a pressure of 750 pounds per square inch has been financially successful in London, and the steam distributing plant in New York has undoubtedly paid ample dividends, yet the difficulties encountered by the two companies using these systems have been so great that it is doubtful whether there will be in future any considerable amount of power distributed in this manner from plants yet to be constructed.

The transmission of power by means of natural gas through long pipe lines has been so completely successful in this country, and the great economy of the Popp compressed air system in Paris, indicate that these means of transmission may become competitors of electrical transmission systems over very considerable dis-

tances. The transmission of fuel gas at a high pressure is not of particular importance where the coal mines are distant, except in so far as the construction and maintenance of the pipe line bears upon the question of the transmission of compressed air. The fact that the combined efficiency of an air compressor and motor may reach as high a value as 80 per cent. shows that the high efficiencies realized with dynamos and motors may be equalled and perhaps exceeded with compressed air apparatus.

The great advantages incident to a compressed air transmission are to be seen when we consider that the power is readily subdivided into small units, and that an ordinary steam engine, with but few modifications, is capable of acting efficiently as an air motor; that the danger of life and property is a minimum when it is compared to any other system of transmission, and that no return mains are necessary, either for obtaining the greatest economy, or for the disposition of disagreeable products. As regards the efficiency of transmission, compressed air is at a disadvantage only when compared with electricity at a high tension transmitted by overhead lines, although recent statements are made by pneumatic engineers which may lead to the economical use of air at high pressure.

With air at 115 pounds initial absolute pressure, and an initial velocity of 25 feet per second, the terminal pressure at the end of ten miles will be equal to 85.7 pounds and the terminal velocity equal to 33.6 feet per second, when a twelve-inch main is used. If the initial velocity is increased to 50 feet per second, then at the end of six miles the pressure will have been reduced to that of the atmosphere. It is therefore seen that pipes of a large diameter must be laid for the transmission of compressed air at low pressures over a considerable distance, and that although the total amount of power transmitted will be increased, it has not yet been definitely determined whether any advance in efficiency is obtained by increasing the initial pressures. The new mains laid by the Paris Compressed Air System, 7 kilometers in length and 20 inches in diameter, using air at 90 pounds per square inch, are capable of transmitting 6000 horsepower. With a main of this size, the necessary construction for guarding against excessive leakages is of course very expensive, and in some instances it has been found necessary to lay double mains, one enclosing the other, in the natural gas region, where pressures from 250 to 500 pounds per square inch have been encountered. The demand for high-pressure air-pipes will no doubt produce something much better and cheaper than is now to be obtained, and the immediate future will determine whether high-pressure air is to be a successful rival of high-tension electrical currents. For shorter distances and lower pressures we have the results of the Paris Company to assure us that a loss of pressure exceeding 8 per cent. is unnecessary in a city net-work containing thirty-four miles of pipe. This economy, we think, compares favorably with the results obtained in the transmission of electricity over small distances, and indicates that in cases where large water powers are available near manufacturing centers, the question of the total initial cost of plant and economy of management demands very careful consideration before it is possible to say that an electrical transmission is the more certain to be successful.

Electrical transmission has the undoubted advantage of having been more completely exploited and the sources of economy more completely understood, but with the introduction of more efficient air compressors and motors we are beginning to see the possibility of a serious competitor in compressed air for delivering power to many consumers throughout a manufacturing center.

NATIONAL SCHOOL OF ELECTRICITY.

Of late several classes of the National School of Electricity have been organized in several cities of the Pacific Coast under a plan of instruction similar to the Chatauqua courses in literary circles. The lesson leaves of the National School were prepared by Prof. Dugald C. Jackson, of the University of Wisconsin, which at once places their accuracy and reliability above question. The mode of procedure is simple. Upon the organization of a class in any locality an instructor is selected who uses the leaflets as a text, illustrating each lesson by means of experimental apparatus furnished by the school. Each course embodies some thirty odd lessons, at the conclusion of which the student should have acquired at least elementary information concerning the fundamental principles and the general applications of electrical science. The student will have learned, for instance, how to technically distinguish between an electrical possibility and an electrical impossibility—a perception, which, if possessed by all business men, would prevent investment in the many fraudulent schemes that are daily foisted upon the credulous public. The National School does not profess to turn out finished electrical engineers, and those aspiring to thoroughness in that profession must look to such well-established seats of learning as the University of California or Stanford University for their education. Its course is one eminently adapted to the needs of the business man who desires general information concerning electrical matters, but who has neither the time nor the inclination to make himself profound in the subject.

The National School of Electricity has been the recipient of no little comment, favorable or otherwise, at the hands of the electrical press. We know that the names on its honorary faculty insure accuracy and thoroughness in the technical preparation of its lesson leaves throughout the scope they are designed to include. The School has struck a popular chord, for it now has enrolled throughout the country upwards of 4000 students, while, in the west, hundreds stand ready to enlist when they are convinced that the administration of the scheme shall prove as unimpeachable as are the names of its honorary faculty. With the organization of the San Francisco class of the National School is presented an opportunity for determining the real efficacy of a scheme that the eastern electrical press and reports have harped discordantly upon, and the conclusions thus reached will here be recorded.

Passing Comment.

AN EDITORIAL REVIEW OF CURRENT EVENTS AND PUBLICATIONS OF OUR CONTEMPORARIES.

The Electrical Engineer has devoted prominent space to an article by Mr. George D. Burton on smelting refractory ores in an electric furnace, in which he reports results that may be important to California miners; in fact a number of the experiments seem to have taken place in this State, though the results which are stated most concretely refer to the smelting of copper ores in Canada. "Electricity" has charged that the statements in this article are manifestly inaccurate, though it does not venture to give any figures to show where the inaccuracies lie. Perhaps exception might be taken to the statement made by Mr. Burton that the smelting charges for gold and silver ores amount to as much as seventeen dollars per ton, though he is very careful to state that this is true only in some cases. A smelter charging so high a price would hardly do a very extensive business amongst California miners. On the other hand, in giving a concrete example of what can be done with his electrical furnace, Mr. Burton states that he has smelted a ton of Canadian nickel ore with an expenditure of 2000 amperes at 250 volts in forty minutes, producing a mat containing 27½ per cent. of pure nickel. The energy delivered in the time stated by Mr. Burton amounts to the delivery to the ore of about a million and a quarter of heat units. While taking the statement made by the best Government assayers that Canadian nickel ore contains about 3 per cent of nickel and a similar amount of copper in "gangue" (composed mainly of iron pyrites) and referring to the table of specific heats given by F. W. Clarke in his Smithsonian publication, we find that more than three million heat units will be required to raise the mass of a ton of ore to the temperature of smelting. This presents a discrepancy in figures, which Mr. Burton will find hard to reconcile.

Judging from the articles seen in several recent papers, it appears that the manufacturers of incandescent lamps are greatly concerned over the question of a satisfactory universal lamp base to facilitate the handling of stocks in these days of low prices. One will readily appreciate the difficulty when it is stated that an incandescent lamp manufacturer must carry stocks of fifteen or twenty different voltages, and that these lamps may be ordered at any time to fit in one of half a dozen different kinds of lamp sockets. The cost of the caps for the different sockets vary from one-half cent to five cents, yet lamp users can rarely see why they should pay more for a Schaefer or Thomson-Houston base than they would for an Edison or a Westinghouse. Undoubtedly the elimination of many odd bases, and the reduction to one or two forms would facilitate carrying stocks, and greatly decrease the cost of manufacture, but on the other hand, the user sometimes has good reason for his choice of a definite socket or of more than one socket in the same building. Plants which are run from storage batteries, and plants in which the regulation of light is affected by a change of voltage in different parts of the system, as well as occasional plants using both direct and alternating system of different voltages need an easy method of separating their stocks of lamps, and there is no surer guard against error on the part of ignorant workmen than can be found by using different sockets for different kinds of lamps. There is also the need in hotels and public buildings that the exchange of lamps from one socket to another be kept entirely in the hands of workmen appointed to make such changes, and as no method for locking a lamp in its socket has been devised, such plants must be equipped with more than a single style of base. If there is so urgent a need for the solution of this question, it may be found rather in the method employed by German lamp manufacturers than in the attempt to have a standard base adopted. The lamp makers in Germany, who are undoubtedly producing and selling lamps at a lower price than those elsewhere, have for some time adopted the plan of putting the lamps on the market entirely without bases, and allowing selling agents and central stations to do their own capping, and, where capping is done by the manufacturer, to make a charge covering the cost of the particular cap applied to the lamp. Under such circumstances, lamps can be had at a definite cost for the lamp itself, and all users of the lamps adopt the particular socket which will allow the cheapest lamp base adaptable to their needs.

In the Electrical World for September 14th appeared an article by Keppele Hall appealing for better construction work on the part of contractors doing interior wiring, in which the sweeping assertion is made that this work is done on an average by men incompetent on account of deficiency in training, and who are both unable and unwilling to do so much as a neat job in carpentering. No doubt, in many small towns where electricity has only recently been introduced into dwellings, there is much justice in this statement, but we hardly think that it is true on an average that men doing electrical wiring are of the character described. No better proof of the improvement in efficiency made by electrical contractors can be found, than on the one hand, the gradual disappearance of the poorest grades of insulation on the market, and the steady growth of manufacturing companies who have uniformly preserved a high standard for their wares. On the other hand, we have the results published by the insurance inspectors to prove that, in spite of the great increase in the use of electricity during the past years, the proportion of fires due to defective workmanship in electrical installations has very greatly decreased. It is unfortunate that it has become the custom on the part of men of short experience, who have established themselves in districts where a greater or less amount of slipshod work is going on, to jump at once to the conclusion that their experience is the common one throughout the country. On the contrary, the average character of the electrical contractors is steadily rising, and architects are recognizing the necessity for the aid of efficient electrical engineers in laying out and subdividing the wiring systems, until throughout the manufacturing centers of New England, as well as in most large cities, but little work is undertaken without the personal supervision of some engineer. It appears that at no time in the history of electric lighting has there been less call for such a plea than at the present, and there is no doubt but that if the present demand for efficient superintendence in electrical undertakings is continued, the slipshod contractor will disappear on account of the unfavorable character of his business.

The Electrical Review of September 25th prints an interesting article on Hornsby-Akroyd Petroleum Engine, which may take an important position in the field for cheap prime movers, and which contains elements that might profitably be studied by the local manufacturers of gasoline engines. It has been the practice of gasoline engine manufacturers to rely almost entirely upon an electric spark for igniting their gases, and every user of these engines knows the difficulties that are encountered in keeping the batteries, spark coils and conductors in working order. English engineers have largely abandoned the spark coil for a porcelain tube ex-

tending into the explosion chamber, and maintained at a red heat by means of a small Bunsen burner playing upon the inside of the tube. By this means, the ignition of the mixture is effected whenever the mixture of gases attains the proper constitution and density, and, as a result, more constant service has been attained. From the standpoint of the manufacturer, the certainty of ignition may seem less important than a complexity of governing gear, and we venture to assert that should our manufacturers overcome this great trouble to the users of such engines, there would be small objection raised to the added parts necessary for effecting governing by the variation of the amount of injected gas.

Literature.

FACTS and HIGH PRESSURE. Pamphlets for gratuitous circulation, BABCOCK AND WILLCOX COMPANY, New York, 1895, by Chas. C. Moore & Co., Pacific Coast Managers, 32 First street, San Francisco.

We have lately received from the Babcock and Willcox Company two pamphlets concerning the manufacture of water tube boilers. These pamphlets are additions to their very valuable book on "Steam," which is familiar to all engineers. In the pamphlet entitled "Facts" is contained descriptions of the various water tube boilers designed in this and other countries from the early attempts of Stevens in 1805 down to the more modern boilers exhibited at the Chicago Fair. All of the designs are here described under four distinct heads: First, boilers containing tubes with closed ends; secondly, boilers composed of bent pipes; thirdly, boilers composed of pipes and fittings; and fourthly, boilers composed of pipes closed at both ends. In each case the boilers are described with the implication that they have been abandoned on account of the impossibility of cleaning the tubes, but it seems to be too much of an assumption for any manufacturer to claim that such boilers as the Thorneycroft, Morrin or Sterling have been entirely abandoned, or to imply that the Henshall boiler is no longer manufactured. There is no doubt but that this pamphlet contains a great number of important forms, and, directly considered, will guard the purchaser against abandoned experiments, though it is unfortunate that no tests are given with any of these important designs.

In the pamphlet on "High Pressure" we are pleased to see so complete a description of the methods of manufacture and materials used in producing the Babcock and Willcox boilers for high pressure steam. Recent advances in steam engine manufacture have created a demand for boilers capable of delivering steam at pressures even as high as 200 pounds per square inch. Where such high pressures are used it is necessary that we be assured of perfection in every part of the manufacture of the boiler, and it is no small consideration to the engineer for him to be able to see so well an established firm as the Babcock and Willcox Company are, manufacturing their admirable type of boiler in a manner calculated to give as nearly perfect results as can be obtained.

ELECTRICAL MEASUREMENTS: A Laboratory Manual; H. S. CARHART, M. A., L. L. D., and G. W. PATTERSON, JR., M. A., B. S. Allyn & Bacon, Boston, pp. 350.

It is with considerable satisfaction that we take up the Laboratory Manual of Professors Carhart and Patterson, and notice that the modern methods of measurement heretofore accessible only in "Gray's Treatise on Absolute Measurements" have been reduced to such clearness that they become intelligible to students, and susceptible of being applied by the average engineer. The special apparatus of the particular laboratory from which the book is issued has not dominated the character of this treatise or burdened it with the defects of other laboratory manuals which have been heretofore issued. The fact that these authors have treated the subject of electrical measurements from the stand-point of the physicist rather than that of the electrical engineer, has divested their work of a considerable amount of complication and unnecessary detail, while at the same time an extension of their methods of measurement to practical application lies within the power of an engineer using the book, on account of the distinctness with which the various quantative measurements are explained. Being written from the standpoint of physical electrical measurements, the subjects treated are limited to the measurements of resistance, current, electro-motive forces, quantity and capacity, induction, magnetization and hysteresis. The discussion of units, which forms the introduction to the work, are entirely in accordance with the scientific c. g. s. system, and treat the results of the Paris and Chicago conventions most completely. The entire elimination of all other systems from this chapter unfortunately fails to clear up the mind before the average student the complete subject of dimentional formula. Even the physicist must occasionally refer to the papers of engineers where complicated unit systems are in use, and it seems that the authors would not have degraded the quality of their work had they introduced examples showing the methods of conversion from the British unit systems into the scientific c. g. s. system.

Where apparatus has been described as in the case of resistance boxes, galvanometers and scales, balances, standard cells and standards of capacity, the treatment is particularly rational and specific; though the necessity for absolute cleanliness and high insulation of all keys and wires is given more by implication than direct instruction, which is perhaps all that is necessary in a well-arranged laboratory, where tables are dry and free from fog and dust, but which must be insisted upon both to the practical engineer and to the student working under less than ideal conditions. In the same vein we would desire more specific instruction concerning the adjustment of a differential galvanometer throughout its range of reading, rather than simply at the zero point. The treatment of the Wheatstone bridge and its errors is noticeably complete, but the difficulty in locating the minimum point of deflection of the galvanometer, which most students experience, might well be borne in mind, and the production of an appreciable swing by timing the contact and periodicity of the galvanometer as used by Faraday and Henry should not be considered beneath the notice of the modern experimenter. The example given of the change of resistance of a dielectric with electrification shows this action, although in the text of the experiment we fail to find any mention of its existence or signification.

It is fortunate that so clear a description of the silver and copper voltameter has been at last made accessible to those not having Raleigh's papers or Gray's Manual at their hand, and the familiarization of this piece of apparatus will tend much to the accurate calibration of commercial apparatus. While the treatment of self and mutual induction is undoubtedly as complete as can be found in any other book, it seems unfortunate that the difficulties attendant upon the measurement of distributed capacities and self induction are not indicated with sufficient clearness to avoid the confusion of their measurement with the measurements of localised capacity and self induction. When we come to the subject of magnetism and hysteresis we find the best recognized methods carefully explained, though the errors of Hopkinson's bar and yoke and Bidwell's divided ring methods in the hands of an ordinary experi-

menter seem to be too lightly called to attention. The fact that the machine work, to give accurate results with these methods and to eliminate the influence of the gap at the division of the bar or ring, is one that is unlikely to occur to the average observer who may rely upon these methods. It is to be regretted that these authors have not treated the subject of the absolute measurement of resistance, since the apparatus of Lorentz has become almost a necessary adjunct to any laboratory where low resistance of great carrying capacity is adjusted. The criticisms that have been made of this book are not at all intended to indicate that the work is materially lacking in either scope or method of treatment, but, on the contrary, we have nothing that has heretofore given us so carefully and well the best recognized method of physical electrical measurements.

CRUDE PETROLEUM FOR FUEL.

By Geo. H. Larkin.

Believing that consumers of steam power will be interested in the result of some tests recently made by the writer in the use of crude petroleum for fuel, I have prepared the following. The tests were made under horizontal return flue tubular boilers at the works of the Pacific Rolling Mills, San Francisco, using the Union Oil Company's standard 23 degree gravity fuel oil from the Santa Paula (Cal.) oil fields, fed through the Larkin oil burner.

The oil was pumped from a car tank into an old ship tank holding about 90 barrels, which was placed on a platform slightly raised from the ground about 60 feet from the boilers, on which were placed two drums, 28.4 inches in diameter and about 40 inches high. These two drums were connected to the ship tank and also to the oil pump used for feeding the burners, and were filled and emptied alternately, 30 inches of oil being used out of drum No. 1, which was then disconnected and filled, when drum No. 2 was connected and 30 inches used out of it after the same manner. The water consumed was handled in the same way, two water tanks being used that were filled from the Spring Valley Water Company's system, and 60 inches of water being taken from tanks Nos. 1 and 2 alternately. The oil weighed 19 pounds to each inch in depth of the drum, and the water weighed 257 pounds to the inch in depth of tank. While the weight of the water is, of course, constant, the weight of the oil varies, but as all fuel oil is sold by a standard measured unit of 42 gallons to a barrel, the same number of pounds per inch in drum was allowed, as in previous tests made with other oils, which was considered the simplest and most satisfactory way of determining the comparative value of different oils.

These boilers have been used for all of the previous fuel tests made at the Rolling Mills, and were in good condition, being clean and of good draught, but they were not enclosed in the building. All water connections for both feed and blow-off were disconnected, and blind gaskets were put in where necessary. The boilers were fed by an injector to the disconnected end of the boiler feed pipe, and the steam pipe leading from the boiler was connected to the main steam line of the Rolling Mills, and regular fires were kept up during the entire time of tests Nos. 1 and 2.

For test No. 3, the boilers were separated from the main line and were used to run the 6 and 8-inch mills alternately. This necessitated frequent stoppage of the fire, as at short intervals the mills were shut down and the consumption of steam was only about one-half of the rating of the two boilers. The amounts of water and oil used were carefully measured by men appointed by Mr. P. Noble, Superintendent of the Rolling Mills, and their work was continued during the two or more weeks of the test.

The results obtained from the three tests made are shown in the accompanying table.

Test No. 1 designates the first week's run, from which it will be observed that the boilers were forced considerably above their normal rating, and that consequently the terminal temperature was too high for good economy. The apparent high evaporative efficiency under the conditions given is due to the fact that the oil used was about 9% heavier than was allowed by the measurements per inch in the oil drum, as before explained.

In test No. 2 the stack temperature was reduced to a more theoretical point, and the boilers were run to about their nominal rating, and, as a result, test No. 2 shows considerably better efficiency than test No. 1. The increased evaporation is the direct result of a reduced terminal temperature, and the high efficiency attained is due to the fact that the furnace temperature was very high, while the terminal temperature was almost theoretical. That these boilers furnish practically dry steam to the main line is an assured fact, and while no calorimeter was used, there was no lack of opportunity to observe the appearance of the steam at the openings left at the connections of the steam pipe to the steam drum on the boilers, and at these points the steam showed bluish in color and nearly transparent at some distance from the orifice.

While the results of test No. 3 are absolutely correct, they are apt to be misleading, unless more fully explained. The boilers were disconnected from the main line, as stated, and were connected to the 8-inch mill without any stoppage, and as they had been running for 112 hours continuously, at their normal rating, the heat stored up in the brick work became active upon the fires being reduced, and the boilers ran at about one-half the rated capacity. This explains the high showing made by oil in this separated test, the duration of which was only 8½ hours. The percentage of gain would of course be less the longer the test was continued.

In tests Nos. 1 and 2 the fires were started under cold boilers, and the amount of oil used in getting up steam is included in the table. At the conclusion of the tests, the oil and feed water were shut off at almost the same time, the water in the gauge glasses being brought up to the same level as when starting up. This left the boilers full of hot water, and the brick work hot, for which the oil received no credit. This difference is plainly shown by comparing a continuous run with the 24-hour run, in which the test started and stopped with hot boilers. For instance, the oil and water report for August 30th, shows that the oil used from 11:27 P. M. on the 29th, to 11:09 P. M. on the 30th, was 360 inches, or 6840 pounds, the time being 23 hours and 28 minutes, and water used from 9:10 P. M. on the 29th, to 9:35 P. M. on the 30th, was 420 inches, or 107,940 pounds, the time being 24 hours and 25 minutes. As the difference in time was 57 minutes between the beginning and ending measurements for the water and oil respectively, a deduction of about 15 inches, or 3855 pounds of water, should be made, which makes the water and oil consumption on August 30th to be as follows:

Oil consumed	6,840 lbs.
Water evaporated	104,085 lbs.
Water evaporated, per pound of oil under actual conditions	15.21 lbs.
Water evaporated per pound of oil from and at 212 F.	18.31 lbs.

A deduction of 9% from these results should be made for the difference between the drum measurement and

the actual weight of the oil, which brings the actual evaporation from and at 212° F. per pound of oil to 16.67 pounds for a continuous run of 23 hours and 28 minutes.

CRUDE PETROLEUM FOR FUEL.

Oil used, California crude, from Santa Paula, Cal.
Kind of boilers, horizontal return tubular.

	Test No. 1.	Test No. 2.	Test No. 3.
Size of boilers.....	54″x16′	54″x16′	54″x16′
Number and size of flues..	54 4″	54 4″	54 4″
Rated horse power.....	75	75	75
Steam pressure	75	75	75
Temperature of feed water	60° F.	60 F.	60 F.
Stack temperature (av'g).	600 F.	480 F.	400 F.
Total oil consumption....	46,217 lbs.	31,198 lbs.	1,463 lbs.
Total water evaporation..	707,778 lbs.	460,030 lbs.	23,130 lbs.
Pounds of water (60°) evaporated ₱ lb of oil..	14.09 lbs.	14.74 lbs.	15.80 lbs.
Pounds of water (212°) evaporated ₱ lb of oil..	16.79 lbs.	17.55 lbs.	18.83 lbs.
Total HP developed.....	27,231.5	17,634	886
HP per hour.....	260	157	104
HP per boiler.....	130	78.5	52
Oil used per HP hour.....	1.8 lbs.	1.7 lbs.	1.6 lbs.
Duration of test.....	104 h. 35 m.	112 h. 9 m.	8 h. 30 m.

SOME TESTS OF BICYCLE LANTERNS.

By F. E. Smith.

Believing that publications of the tests of the various means in use for lighting bicycles at the present time will be of popular if not technical interest, the writer gives below the results of measurements originally made as a matter of personal satisfaction. Before presenting the same it is well, however, to point out the distinction that should be drawn between a riding light and the signal light. The lanterns ordinarily used can, after a consideration of these experiments, be considered only as signal lights, or those containing visual warning of approach. As a means of illuminating the roadway they can be considered only as a partial or doubtful success. With a riding light, however, the roadway becomes sufficiently illuminated for thirty or forty feet, or even a greater distance ahead, so that travel can be accomplished with ease and safety. In the present state of bicycling by night, signal lights without number are available, but riding lights, though eagerly sought, are not to be obtained. Original experiment in this direction led to the construction of an electric lantern, consisting of three cells of storage battery operating a small one candle-power incandescent lamp arranged in a suitable reflector placed upon a bicycle, as shown in the accompanying illustration. This is the apparatus referred to below.

The two forms of oil lanterns which are believed to be the best were selected for the test. These burned signal oil and kerosene oil, respectively, and their weights, when filled, were 20 and 40 ounces, respectively. They were tested under the best possible conditions as to trimming, polish, etc.

The electric lantern is operated, as stated, from three cells of storage battery of the Hough type, each cell containing two plates $1\frac{1}{2}$ inches by $3\frac{3}{4}$ inches in size. The lamp used was manufactured by Geo E. Lamont, a San Francisco manufacturer, and is rated at one candle-power, is of 4 watts efficiency, and consuming .7 of an ampere at 6 volts. The battery will operate this lamp about four hours continuously. The weight of the battery and lamp complete is 36 ounces.

All candle-power measurements were made by means of the standard Lummer-Brodhen photometer in the laboratory of the Edison Light and Power Company of San Francisco, the photometer having a distance of 100 inches between centers. For a standard, a 16 candle-power incandescent lamp, previously standardized from standard English sperm candles burning 120 grains per hour, was used, and under these conditions, which are accurate, the various lanterns gave the following tests:

Some Tests of Bicycle Lanterns.

Oil lantern No. 1, burning signal oil..... $3\frac{1}{4}$ candle power.
Oil lantern No. 2, burning kerosene..... $6\frac{1}{2}$ " "
Electric lantern, consuming 4.2 watts.....45 " "

I may add, as an illustration of the efficiency of the electric lantern, that during the recent eclipse of the moon, when no street lamps were lighted and the streets of San Francisco were in intense darkness, I was able, with the aid of the electric lantern on my bicycle, to discern another bicyclist turn into the street at the further end of the block, a distance of 600 feet away. The electric lantern gives a splendid riding light and illuminates the roadway brilliantly for a distance of 50 feet. In addition to the headlight, there can be used a rear electric lantern, operated from the same battery, to be used as a signal light. In my machine this consists of a red light attached to the saddle post and pointing backward.

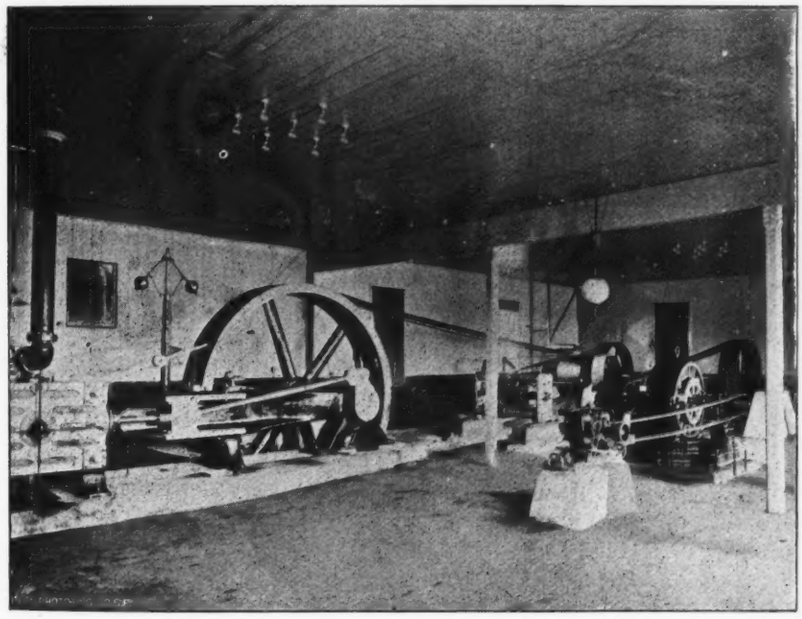
Mr. G. P. Low has decided to call his excellent electrical paper, published in San Francisco, The Journal of Electricity, under which name he will continue to demonstrate the high stage that electrical engineering and education has reached on the Pacific slope.—Electrical Engineer, New York.

We have at last received a copy of the first issue of our new contemporary. The venture has received no little attention in the United States, and it is with interest that we turn over its pages * * * The articles are good.—Electricity, London.

A COMMERCIAL SUCCESS FROM A MUNICIPAL FAILURE.

A noteworthy instance in which municipal authorities have taken up the question of city lighting and have installed a plant to meet the conditions which they believe to have existed, and after extensive trial have failed to score a success, while the same plant after having passed into the control of private parties has rapidly built up into a paying venture, is illustrated in the station at Berkeley, Cal., the interior of which is shown in the accompanying cut, reproduced by the permission of the Berkeley Herald.

In 1893 the town of Berkeley, Cal., after a profitless experience in running its own electric plant, advertised for bids for the lease of the plant and doing the city lighting. Two competitors for the contract — the Oakland Gas, Light and Heat Company, and the San Francisco Electric Company — made bids that were the same, but in the specifications of the latter were details advantageous to Berkeley, by reason of which the San Francisco company secured the contract. On September 11th



A Commercial Success from a Municipal Failure.

of the year named, the San Francisco Electric Company, through Mr. J. Geo. Gardner, General Manager, secured control of the plant by effecting a combination with the Berkeley Electric Light, Heat and Power Company, and the reorganized concern, under Mr. Gardner's management, soon placed the enterprise on a business basis, and at present the investment is rendering satisfactory returns.

Among the first improvements made in the old installation was the placing of a new tubular boiler and an Eclipse Corliss Engine, each having a capacity of 200 horse power, and also the installation of two La Roche alternators, having an output of 36 amperes and 75 amperes, respectively, or a combined capacity of 2000 16 candle-power incandescent lamps. In addition, the plant operates 65 2000 candle-power arc lamps for municipal purposes from one 75 lamp 9.6 ampere Ball arc lighting dynamo. The incandescent service is rendered on meter rates, with the usual results, for it is found that although 2400 lamps are wired in on the circuits, the maximum load carried is but 800 lamps. The business is rapidly growing, and is quite satisfactory.

Correspondence.

ELECTRICITY IN PLANT GROWTH.

The original ideas presented in the article of Lieut. Stuart-Smith on "Electricity in Plant Growth, and Light in Chemical Decomposition," presented in the September number of the Journal of Electricity, are exceedingly important suggestions of the possible connections of observed effects, which seem heretofore to have been unconnected. The relation between the crop reports throughout the country, and the eleven-year sun-spot periods have long been noticed, although scientific men have felt that rather a coincidence was indicated than that there was any necessary connection between the two facts. Mr. Stuart-Smith has pointed out that the experiments of Prof. Warner, at Amherst, Mass., seems to give the connecting link between these observed effects, which have heretofore appeared to be so widely supported. Our meteorological observers have not made the observations necessary for the proof or disproof of Lieut. Stuart-Smith's hypothesis, though before such observations are likely to be undertaken it is necessary that a correlation of facts, already at hand, should indicate whether there is a strong probability that such observations would lead to important results. In the records of the astronomical observatories are to be found complete reports of the condition of the sun for a great number of years, and, since the establishment of Gauss and Weber of magnetic observations, many records have been preserved of the existence and character of magnetic storms. These two sets of data have been found to correspond with each other, and it is now definitely believed that the presence of spots on the sun exerts a magnetic effect on the earth, inducing strong earth currents. Whether the crop reports follow more closely the periodicity of the sun spots or of the earth currents has not been so clearly established. The variations in the actinic properties of sunlight, of which Lieut. Stuart-Smith speaks, are altogether unobserved as yet, and until definitely proved that there is a relation between the existence of spots upon the sun and the actinic activity of sunlight on the earth's surface, we will necessarily be in doubt as to whether the characteristics of the sunlight or the existence of earth currents has a greater effect upon plant growth. The practice of the market gardeners about the city of Boston of forcing their vegetables by lighting their garden with arc lights, would indicate that an actinic change in sunlight may probably be found to be more influential in plant growth than the presence of earth currents, though up to the present time experiments on a large scale have not been made in forcing plant growth by means of these currents. S.

San Francisco, October 17, 1895.

The Stirling Supply Company, 54 Second street, San Francisco, has secured the Pacific Coast agencies for the electric light and power apparatus of the Card Electric Company of Mansfield, Ohio, and of the Standard Thermometer Company of Peabody, Mass., manufacturers of the well-known Upton Arc Lamp.

In responding to advertisements please mention The Journal of Electricity.

A DEPARTURE IN ELECTRIC ELEVATOR CONSTRUCTION.

A new type of direct connected electric elevator, which presents several novel features of improvement over the ordinary form, has recently been brought out by Messrs. Cahill & Hall, of San Francisco, and which is shown in side elevation in Figure 1. The particular novelty consists in the way the hoisting ropes are operated, which forms a radical departure in that the hoisting ropes are not wound on a drum, as is the usual practice, but are moved by friction in much the same way that the cable of a cable railway, or the rope of the house mover, or the ship's hawser about a capstan are pulled. The principle upon which these appliances are operated is that so long as the free end of the rope about the capstan, for instance, is kept taut, the rope will keep its grip exerting an amount of pull dependant upon the power excited and the strength of the rope.

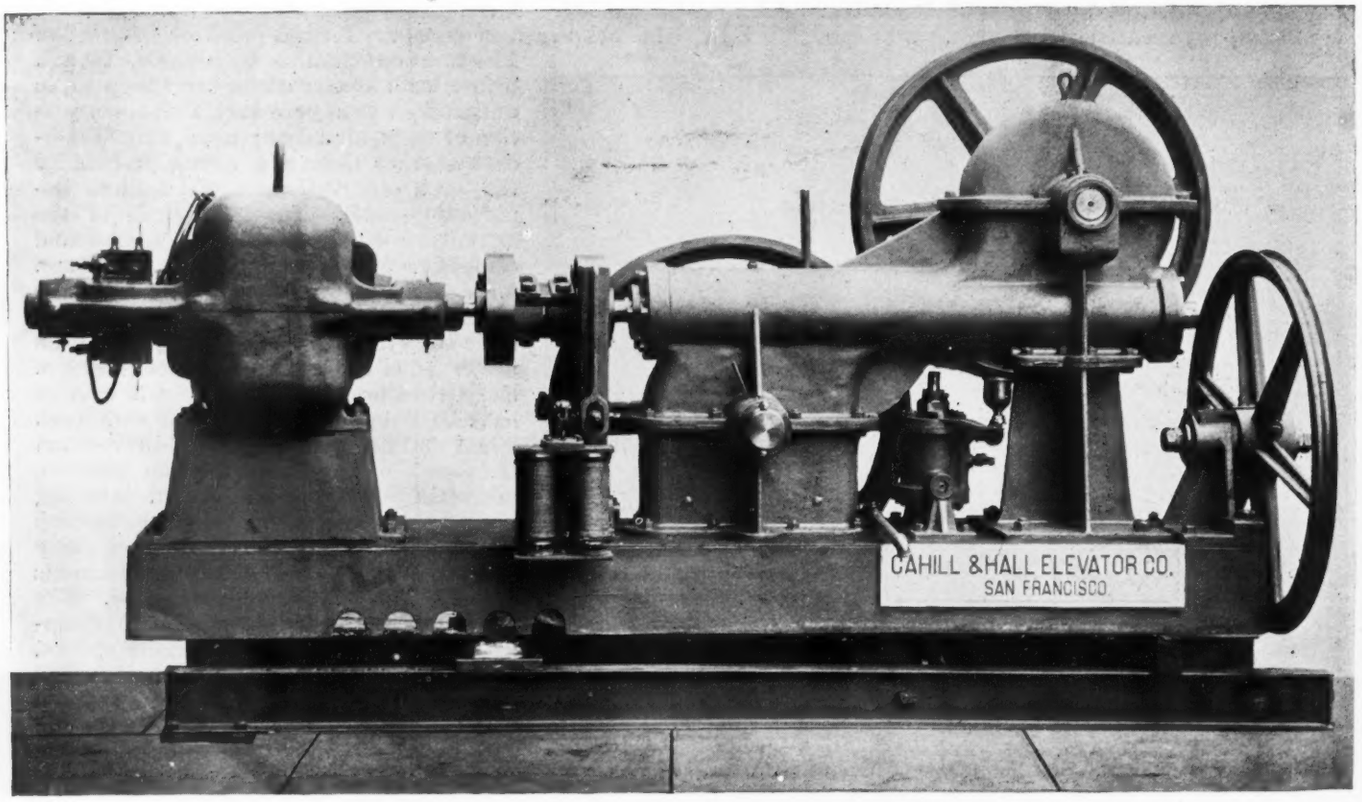


FIGURE 1—DEPARTURE IN ELECTRIC ELEVATOR CONSTRUCTION.

If, however, the free end of the rope is slack, the frictional contact of the rope with the capstan will be freed, and the rope will slip. This principle is executed in a novel way in the distinctive type of elevator designed by Cahill & Hall. It will be seen in Figures 1 and 2 that there are two hoisting ropes. One end of each of these is fastened to the top of a counter weight, whence they pass up and over a sheave mounted at the top of the elevator shaft, thence down along its side to and twice around these traction sheaves designated as C and C′ in Figure 2. From these traction sheaves the ropes continue down and around the front idler sheave C″, shown also in Figure 3, from which it continues up, and is made fast to the under side of the counterweight. The elevator cage is supported by four ropes leading from the top of the car over a sheave at the top of the elevator shaft, thence to the top of the counterweight.

The basic principles upon which the equipment operates may now be understood. As shown in Figure 2, the entire apparatus is rigidly mounted upon a bed plate, which being hinged as shown at Z, is free to tilt either way. The major portion of the weight of the apparatus however, is borne by the idler sheave C″, around which the equivalent of the free end of the rope passes. The weight of the equipment being borne on the rope through the sheave C″, furnishes the power for taking up the slack on the free end of the rope, and if the car meets with an obstacle preventing further travel, or if through any mischance the car should strike the bumpers at the top or bottom of the shaft, the rope will slip upon the traction sheaves, and all danger or damage will be averted. This is a feature which exists in no other form of electric elevator equipment, and is undoubtedly of great value, owing to the fact that with rigid connections between the rope and the winding drum, or between the rope and expansion or thrust sheaves, it is evident that in event of the car striking an unyielding obstacle, the momentum of the motor will impose fierce strains upon the machinery that ofttimes will result in breakdown, throwing the car upon the safety devices. To go more fully into the modus operandi of the Cahill-Hall equipment. as the front end of the apparatus is held up by the idler sheave resting on the hoisting ropes, it is clear that the measure of lift, which may be given to the machine, depends upon the amount of weight resting on the hoistiug ropes, which of course is fixed by the weight of the equipment. If more pull is exerted on the hoisting ropes than there is weight resting upon them, evidently the machine will rise, which will slacken the ropes, and they will slip. By adjusting the weight of the machine, the equipment may thus be made to raise any predetermined load, any material excess of which will cause slipping, which the makers claim to be a most important feature.

In construction, the form of motor used resembles the waterproof type of the street railway motor to a considerable extent. It is therefore of the iron-clad frame type, and has two internal pole pieces. The particular feature that impresses one regarding the design of the

motor is the large amount of iron in the frame, and the entire absence of magnetic joints. The self-induction of the field circuits is very high, and the series coil is so proportioned that the self-induction opposes or chokes back the abnormal current flow that would otherwise occur at starting, because of the absence of counter-electro-motive force due to the armature being at a stand-still. The motor is equipped with self-oiling and self-aligning bearings; its weight is 2400 pounds, and its speed is 800 revolutions per minute.

Those who are familiar with the starting torque of various types of electric motors will appreciate result of a test made by Edward S. Cobb, mechanical engineer, upon the motor in question, and from his report it appears that a 15 horse-power motor having a ten inch armature exerted a starting torque of 2,448 pounds on the surface of the armature, and this with all the resistance of the rheostat thrown in, and with no material heating in either the rheostat or the motor.

The controller used is of the general disc type in which the lever consists of a straight bar insulated and swinging at the center, and which, therefore, acts diametrically, and brings the wipers in contact with strips so arranged as to give the connections necessary. All wipers and contact strips are made removable, and are manipulated by the lever in the elevator car.

That the motor performs its work well is evident by the smoothness and ease of both starting and stopping. The connections given for circuit changes are such as meet general conditions, but, of course, they may be modified in minor details to meet the necessities of different equipments. The motors are wound in standard voltages for 500, 250 and 110 volts, and, except in particular instances, motors having a rating of 15 horse-power amply satisfy all requirements.

It will be seen from the outline drawing in Figure 2 that the armature shaft is extended through insulating couplings L L′ to the worm shaft S, upon which is keyed the right and left hand worm gears A A′, which drive the main sheaves C C′ respectively. This arrangement eliminates the use of a thrust bearing for the worm shaft, resulting in higher efficiency than would be the case with the use of but one gear. Further advantage is realized in this arrangement in that by having two gears, each will be called upon to carry but half the load, hence they will wear twice as long. The gears are filled with oil up to the center of the worm shaft, which insures perfect lubrication.

An equipment installed in the building of the Fred. J. Byrne Block, Los Angeles, Cal., is so geared that for each revolution of the armature the car travels five inches. The travel of the car is 55½ feet, and from tests made, this distance was covered in nine seconds each way. Twenty-two seconds were consumed in making the round trip, including starting and stopping, while fifty-five seconds were consumed in making a round trip with a stop at each of the five floors. To stop at each of the five floors allowing a man to get on and off the car in a way as near actual conditions of operating an elevator as is possible, required ninety seconds for the round trip, all of which would indicate that the elevator was fully to the standard of any modern high speed hydraulic elevator.

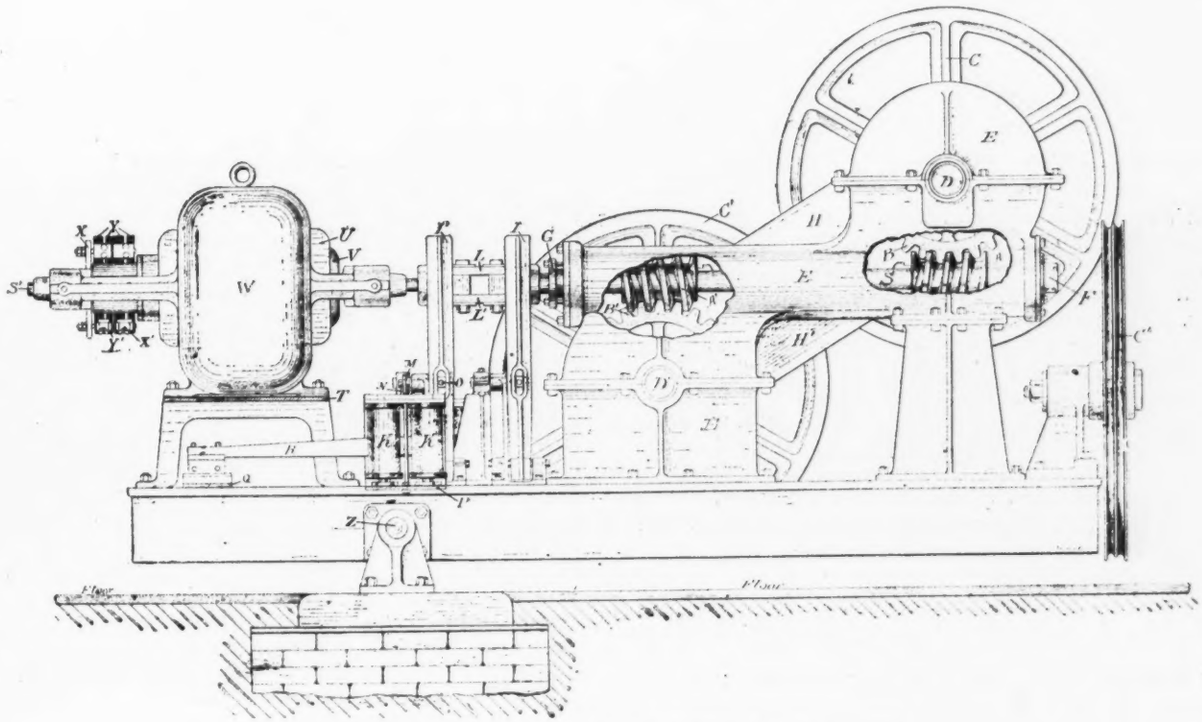


FIGURE 2—DEPARTURE IN ELECTRIC ELEVATOR CONSTRUCTION.

The safety devices with which the system is equipped has been carefully worked out, and, in addition to all ordinary mechanical safeties, two sets of solenoids—one of which appears at K K′, the other being on the opposite side—have been placed for breaking the main circuit, and throwing on the brake I′ and I respectively. The solenoid controlling the brake I is wired in parallel with the shunt coil of the motor, and when excited releases the brake I by raising a heavy weight (not shown) which actuates it through an ordinary form of toggle joint. The solenoid K K′ operates similarly so far as mechanical effects are concerned, but is controlled through contact strips on the car, which make the circuit controlling the solenoid, and at the same time throw the brake I′ and cut the main circuit by raising the lever R, opening the main switch at Q. The main circuit being thus broken, current is taken off the motor, and

the second solenoid (not shown) which throws on the second brake I as described.

The San Francisco Savings and Loan Society has furnished interesting data concerning the advantage of

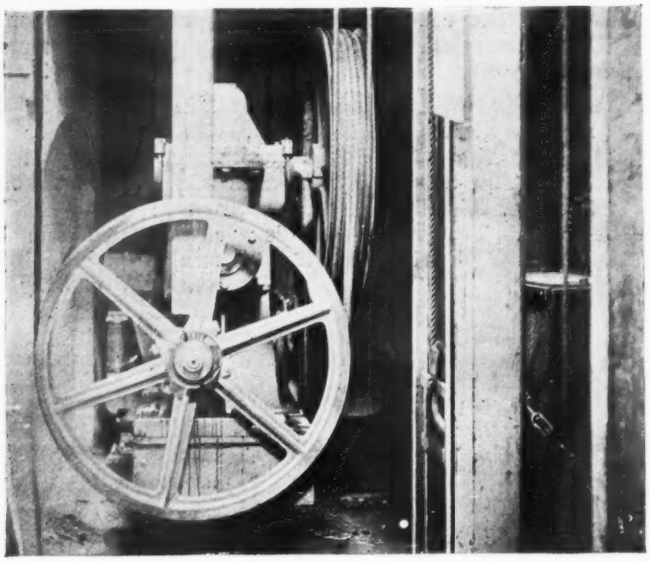


FIGURE 3—DEPARTURE IN ELECTRIC ELEVATOR CONSTRUCTION.

electric over hydraulic elevators. The hydraulic equipment displaced by the Cahill-Hall apparatus consisted of an ordinary vertical cylinder elevator, operated by pressure from the mains of the Spring Valley Water Company. The water consumed was measured by the travel of the elevator for the period stated, which averaged 12,931 feet per day, and the bills rendered from March 5th to August 5th inclusive, show an average consumption of 63,800 cubic feet of water per month, which cost an average of $118.71 per month, in comparison with which the bill of the Edison Light & Power Co. for electric service for the month of September, amounting to $20.80, shows a marked economy in favor of the electric elevator.

TOBOGGANNING OUTDONE.

A decided novelty in the way of an attraction for the amusement-loving public has recently been erected on a block near the Haight street entrance to Golden Gate Park, San Francisco, and which will doubtless be a material factor in increasing the business of the many street car lines of that neighborhood. The attraction consists of what may be termed a water toboggan, or a water chute. The chute proper consists of an inclined plane, 275 feet in length, and built with a rise of 25 per cent. Down this chute boats will shoot with accelerating velocity until the lake at the bottom is reached, when the voyagers will undoubtedly have had enough.

The entire outfit is operated by electric power from the trolley system, and the equipment consists of one twenty-horse-power slow speed multipolar motor for operating the elevators; one sixty-horse-power bipolar motor for driving a fifty-light arc dynamo; one G. E. 800-motor operating the hoist for pulling the empty boats up the chute, together with a pumping plant for keeping the chute well flushed with water. Already the city is flooded with posters asking "Have you shot the chutes?" and before long many San Franciscans will have experienced the fact that there is something new under the sun.

The Trade.

JOHN M. KLEIN'S ELECTRICAL WORKS.

There are hundreds on the Pacific Coast who will be pleased to learn that John M. Klein's Electrical Works has so increased its business as to necessitate moving to a large three-story building, Nos. 421–3 Montgomery street, San Francisco. The present quarters are near California street, in one of the busiest portions of the city, and the establishment having taken the entire building, will fit up the basement as a packing room, the first floor as a store and salesroom, the second floor as a warehouse, and the third floor as its factory, making it one of the most complete electrical manufacturing and supply houses on the Pacific Coast. This removal at once centralizes the various interests of the concern by bringing them under one roof in the best business portion of the city.

The history of this establishment is one of singular prosperity. Mr. Klein started in business with the Western Union Telegraph Co., in New York City, in 1869, as a messenger boy, in which capacity he proved so faithful that in the following year he was given a position in the old Western Union shops on West Fifty-fifth street, where he became a shop mate of many of the veteran telegraphers, among whom were John Gough, A. J. Brown, Charles Bender, George Thompson and others. For many years he remained in the factory, and then came to San Francisco and entered the fire alarm service, where he remained until 1880, when he started in business for himself, his only capital being a well-equipped set of tools and a thorough understanding of the art. An idea of the degree of success attained may be had from the fact that the mercantile rating of the electrical supply house of John M. Klein's Electrical Works is as high, if not higher, than any other similar establishment on the Pacific Coast. Though the firm still embraces Mr. Klein's individuality, the firm has recently been enlarged by the addition of the name of Mr. Marion L. Mowry to partnership, as a result of which the business is being pushed to the utmost degree.

Mr. Mowry, who is a native of California, is well-known in district messenger and electrical circles. He was the founder of the California District Messenger Company in 1882, and the first to start opposition to the American District Messenger Company of San Francisco. In various ways he has been connected with electrical projects, and recently became interested as above stated.

ECHOES OF THE CARNIVAL.

Sacramento City has again assumed its workaday attire, and most, if not all, of the electric lighting equipment erected by the Carnival Committee for decorative purposes has been disposed of at private sale. It now transpires that a single supply house in San Francisco furnished over 14,000 lamps for the Carnival, and an equal number were obtained from other sources. The remaining equipments in the Folsom Power House of the Sacramento Electric Power and Light Company have been completed, as has also the sub-station, and the system is working to entire satisfaction.

Through inadvertence no mention was made of the fact that credit for a great amount of work on the arches and other illuminating effects for the Carnival was installed by the Pacific Electrical Works. This is one of the oldest electrical supply and construction establishments in Sacramento, having been established under the management of C. A. Fisk in 1874, and its store at 1023 Fourth street forms a headquarters for everything electrical.

A NEW IDEA IN TAPE.

The Okonite Company (Limited), always progressive and leaders in all that pertains to their especial line of goods, brought a new idea in tape to the recent street railway convention which created a genuine sensation and caused any amount of favorable comment. The novelty consists of a new form in which the company is putting out the celebrated Manson Tape, and was shown by Captain Willard L. Candee, who was to be found here, there and everywhere, surrounded by an interested group of the electrical fraternity eager to get points on the "good thing."

The usual manner for supplying the trade with tape has been for the manufacturers to put it up in half-pound packages or rolls, incased in tin foil or other wrapping. It is the general experience of most companies that the linemen in using tape so put up, after taking what was needed for the work in hand from the roll, would throw what was left away, or, if they did put it back into their kit, the wrapping would soon become loose, the tape gather dust and dirt, and in a short time become almost unfit for further use.

Captain Candee showed the Manson Tape, packed in round tin boxes of two colors—red and white—both very attractive and neat in appearance, and containing one ounce of the tape. This is, nine times out of ten, a sufficient quantity for any ordinary repair, and if there be any left over it may be put back into the box, which is conveniently small (about the size of a silver dollar), where it will be kept fresh and clean and ready for further use. The new form of packing meets an evident want, and will unquestionably mean a considerable saving to the companies and prove a great convenience to linemen.

The Manson Tape is furnished in two colors; the black tape will be put up in red boxes lettered in black, the white tape in white boxes also lettered in black.

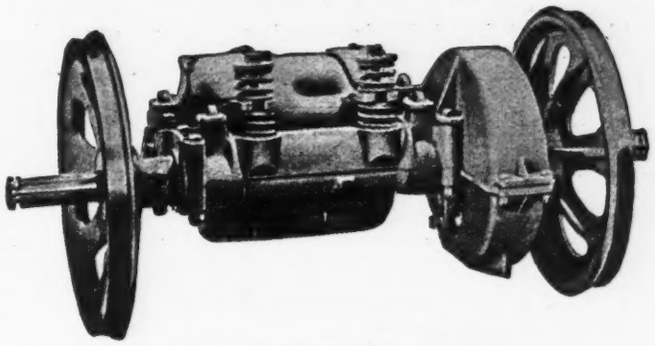
Captain Candee returned from the convention with a large number of valuable souvenirs in the shape of substantial orders for the novelty. It is of interest to state that the tape put up in this way adapts itself perfectly to the needs of cyclists as well, and will doubtless prove as popular in that quarter as for purely electrical uses.

THE WALKER STREET RAILWAY MOTOR.

The latest type of motor manufactured by the Walker Manufacturing Company, is that shown in the accompanying illustrations, and which at once combines all features that have been found of value. It is of the four

WALKER STREET RAILWAY MOTOR.

pole single reduction steel frame type, is of light weight, considering the output, and is in no way attached to the axle except through the springs, which at once practically eliminates the serious items of repair to both track and equipment, consequent to the hammering on the track and rail joints due to rigid suspension. The motor is entirely water and dust proof, and may be conveniently opened from below, which retains the armature in the top half of the casing or by the removal of only two bolts, the armature may be lowered with the bottom half. The armature is of the toothed-drum type, provided with machine-wound, interchangeable coils. The



WALKER STREET RAILWAY MOTOR.

field coils, which are also machine wound, can be readily removed from the frame, and the shaft is unusually heavy with extra large and long journals, while the gears are run in oil in a detachable air-tight casing run in oil. Insulation is effected by the use of mica throughout, and every motor is tested at 5000 volts a. c. A series parallel controller is used, which takes up an exceedingly small portion of the care platform, is both fire and waterproof, and all parts are easy of access for inspection.

The Pacific Coast Agency of the Walker Manufacturing Co. has been placed with the Adner Doble Co., Mechanical and Electrical Engineers and Contractors of Nos. 13 and 15 Fremont street, San Francisco, who report the sale of a 400 horse-power multipolar Walker generator to the Oakland Consolidated Street Railway Company, and of fifteen street railway equipments to the Sutro Railroad Company.

WROUGHT STEEL BOILER CONSTRUCTION.

The recent installation of 600 horse-power of new wrought steel construction safety boilers by the Babcock & Wilcox Company in the power house of the Sutro Railroad Company, together with the erection of 200 horse-power of boilers for the Commercial Steam Power Works, and 60 horse-power for the Hebrew Orphan Asylum in San Francisco, have received close attention by parties who are interested, as the high character of workmanship on the forged parts and drums is something unusual. These "W. S. C." boilers, as this type is termed, have forged steel heads, cross boxes and drum-heads, and are designed for exceptionally high pressure. Mr. Charles C. Moore, the Pacific Coast Manager, has received for distribution among steam users two interteresting pamphlets, entitled "High Pressure" and "Facts." The former specially describes boilers of the "W. S. C." construction, and the latter gives a history of water tube boilers from the inception of the art of steam boiler construction to the present time, indicating the degree of commercial success attained by each.

Messrs. Charles C. Moore & Co. also report recent equipment of thirty steam plants in this section with Stratton Steam Separators and of more than forty plants with Bundy Tank and Return Steam Traps, the latter being a comparatively new device of special economy for returning condensed water direct to the boilers without pumping. Satisfactory sales of Goubert Feed Water Heaters, New York Safety Engines, Snow Steam Pumps and Spencer Damper Regulators are also reported.

The Lay Press.

POPULAR REFLECTIONS OF THE CONDITIONS AND PROSPECTS OF ELECTRICAL ENGINEERING ON THE PACIFIC COAST.

The transmission of electric power is no longer a speculative experiment but a plain business proposition, that commends itself to intelligent investors everywhere.—Santa Cruz (Cal.) Surf.

While capitalists of the State are looking around for electric power, we beg to call their attention to Merced Falls, in this county. If the power there is harnessed up and properly utilized it will produce handsome returns on the investment.—Merced, Cal., Express.

The business boom in the electrical world continues and new schemes for power transmission and other electrical enterprises are being formed, while hustling promoters of other schemes a little older are figuring on the cost of plans and trying to raise capital.—San Francisco Call.

It is not easy to foresee all that this [electric transmission] may mean for the near future, particularly here in the Salt River valley. If the water power which we have could be utilized for generating electricity, there would be no end to the possibilities. —Phœnix (Ariz.) Republican.

Matters in the [municipal] electric light department are still mixed. When the incandescent plant was put in operation things got in a tangle which it seems impossible to straighten out. A number of stores and residences are furnished with lights, but the profit accruing to the city has not as yet been discovered.—Alameda (Cal.) Argus.

The work of harnessing the vast water power of California, most of which is now going to waste, has evidently begun in good earnest. The American River plant at Folsom is already furnishing power for Sacramento, twenty-three miles away. * * * Similar projects are on foot in other sections, and each one will probably prove a highly remunerative investment.—Los Angeles Times.

It is suggested that if the National Republican Convention be held in San Francisco next June, Sacramento might hold at that time a flower carnival, or Electric Carnival, or similar celebration, for the purpose of attracting and entertaining the Easterners. If Sacramento does anything at all, let her have next year another Electric Carnival, for in that direction she can give a pageant unique in its character and which no other city at present can dupliaate.—Sacramento Bee.

It is practicable to pick up Nature's immense stores of power, as represented by the innumerable mountain streams throughout the land, and transport them to the centers of trade, commerce and manufacturing, and convert them to the uses of mankind. Instead of taking the manufacturing establishment to the power, which is often in places difficult of access, the power will be carried whither the manufacturer wills. He will build his factories where they will be easy of access to transportation, and bring the power of the mountain streams to them. And this is not an idle dream—it is not a dream at all, but an established, practical reality.—Nevada City (Cal.) Herald.

In California there is no Niagara to harness, but there is a steady fall of water from the Sierras capable of furnishing more power than will be needed for generations to come. A practical beginning of utilizing these streams has already been made, and it will be a misfortune for San Diego if it fails to become a competitor for these future manufactories. The mountain streams only a few miles distant can be made to furnish ample power at moderate cost. The facilities for transportation by water render this city a much more desirable place for manufacturing establishments than interior points. The subject is certainly one worthy of careful consideration.—San Diego (Cal.) Union.

There is no limit to the possibilities that lie before manufacturers and others who depend upon the creation of some form of force. Electricity is the coming motive power, but electricity must be caused by some exciting agency and to-day the usual means is a steam engine which turns the armatures of dynamos and so produces the current that is then used for lighting and various purposes. But this depends upon coal, and coal is neither cheap nor plentiful in California. Hence, our salvation is in the means of utilizing our streams. * * Some of our local capitalists have recently examined a canyon near Healdsburg, which they think will solve the problem for Santa Rosa. The canyon is twenty feet higher than the Russian River. The plant, it is estimated, will generate from 2,000 to 5,000 horse-power, and it is expected that with additional turbines and canals running out of the initial dam at least 10,000 horse-power can be derived.

Enthusiastic citizens here are declaring that in a short time Sonoma County and the entire State will be the scene of prosperous factories run by this new power so cheaply obtained from the hills.—Santa Rosa, Cal., Democrat.

When power for the generation of electricity for transmission is under consideration, Stanislaus County looms far above all other sections of the State. The great irrigatfon dam at La Grange affords advantages in this direction that are simply stupendous. Light, heat and power could be furnished to Merced, Modesto and Stockton on the plains, as well as the lesser towns, and to Coulterville and other towns of the mountains. An electric railroad from Modesto to Coulterville would make this city the base of supplies for the mining town and all adjacent country, as well as give us all the traveling and transient business, a very valuable consideration. The cost of constructing and equipping such a road would not be excessive, and the enterprise would pay its promoters and handsomely enhance the business of the town. —Modesto (Cal.) Herald.

H. W. Gray, the contractor who built a portion of the ditches of the Modesto and Turlock irrigation district, says: "There is already going to waste power enough for the submerged dam on the Tuolumne river to operate an electric railroad from there to Stockton on the north and to Fresno on the south. That dam was built by the Modesto Irrigation district. It is in the Tuolumne river and about thirty miles from La Grange. It is 126 feet in height, and supplies 2100 cubic feet of water per second for the district. The district will probably use not more than 1000 cubic feet per second. At the driest season of the year there is 200 cubic feet of water per second. There is a dam already built, with water flowing over it at a height of 126 feet, which would furnish all the electric power needed to operate a railroad from that point to Modesto, and then on either side to Stockton or to this city. As it is now, the power of that mighty force of water is going to waste. That dam is only one of many which may be built for the purposes of irrigation, which may also be used to generate electric power for railroads. The whole western slope of the Sierra Nevada drains an almost incalculable amount of water, which is gathered according to the watersheds into creeks and rivers. There is the Merced River, which has fall enough to supply enough power to operate an electric road to a point on the Bay of San Francisco. The same is true of the Fresno River and the San Joaquin, the King, the Tule and the Kern Rivers. All those are great rivers with capacity of generating great power, which may be used for electric roads or for manufacturing plants "—San Francisco Chronicle.

California cannot be too prompt to make commercial use of the power in her streams to provide it with electricity. The first great experiment—on the American river at Folsom—is successful. A hundred other schemes for putting traces and collars upon the moving waters are in the air. From Lake, from San Diego, from Kern, from Calerveras come reports of projects to make the waters do the hard work for man. Use of water for power for the electric road to be built to the Yosemite Valley is entirely within possibility, and the visitor to the wonderland may ride swiftly by the force of the very waterfalls that enchant his vision at the end of the trip.

The Directors of the San Francisco and San Joaquin Valley Railway would not be wasting time by giving consideration to the feasibility of the use of electricity as the motive power for its trains, and to investigating how power may best be obtained from the Stanislaus, the Tuolumne, the Merced, the King and the Kern. The topography of the country through which the Valley Railroad will run its way is peculiarly adapted for an electric railway, and nowhere else in the world has nature placed the power more accessible. One of the reasons for selecting the Nantasket branch in Connecticut as the line for experiment is that within its short limits are condensed most of the difficult problems which will have to be solved before electricity can be recognized as a successful substitute for steam. The grades are steep and the curves sharp and frequent. The Valley Railroad will run through a level valley, and will be free from either steep grades or sharp curves.

The electric locomotive has but to be developed one degree further to be ready for use on just such a railroad, and, in the mean time, California should be preparing to receive the locomotive. The union of the largest factory in the world for supplying motive engines with an electrical company means more than speculation for constructions for suburban roads. It means that the great railroads are going to turn their attention to electricity. The change from steam should come first where natural power can best be applied.—San Francisco Examiner.

Reports of the Month.

LITIGATION.

SPOKANE, WASH.—The Union Light and Power Company has been defeated in its suit to enjoin the City of Spokane from interfering with the construction and maintenance of its lines.

SEATTLE, WASH.—The City Council has passed an ordinance requiring all electric wires put underground inside of ninety days. All electric companies, together with many prominent business men, have signed a petition to the Council, in which the electric companies agree to use but one pole line on either side of each street, with six poles to the block, and that all other poles shall be cut down.

COMMUNICATION.

FRESNO, CAL.—The Sunset Telephone and Telegraph Company has completed and is now occupying a vitrified clay underground conduit system covering that portion of the city bounded by Fresno, Kern, I and N streets.

SACRAMENTO, CAL.—The contract for the 12,000 feet of aerial telephone cable required by the Capital Telephone and Telegraph Company was secured by the John A. Roebling's Sons Company, and the material has been delivered and is in use.

SAN FRANCISCO, CAL.—R. B. Elder, Pacific Coast agent for the Chloride Company, reports the sale of several storage battery plants, among which is one of thirty-six cells of chloride battery for operating the new Express Exchange for Sacramento.

TRANSMISSION.

RIVERSIDE, CAL.—The Board of Trustees has advertised for bids for electric power purposes.

REDWOOD CITY, CAL.—Efforts are being made to operate the new electric plant here by water power.

KENNEDY, NEV.—The Schweitzer Electric Milling Company is erecting machinery to work custom ores.

SAN DIEGO, CAL.—F. S. Hartwell has been appointed agent for the Walker Manufacturing Company for San Diego county.

VISALIA, CAL.—The Kaweah Irrigation and Power Company is purchasing a complete outfit for excavating the proposed power canal.

BODIE, CAL.—The Standard Consolidated Mining Company has completed the big dam for its electric power station at Green Creek.

BAKERSFIELD, CAL.—Alfred Billing has filed a claim for 35,000 inches of water of Kern River, to be diverted at a point in Section 17, Township 27, Range 32.

WANETA, WASH.—The Kootenay (Ida.) Hydraulic Mining Company has altered its plan, and instead of furnishing water for mining purposes, proposes to place an electric plant and furnish electric power.

WOODLAND, CAL.—The Rumsey and Tancred colonies are considering the advisability of putting in an electric transmission plant to furnish power for pumping water from Cache Creek to be used for irrigating the Tancred colony and the surrounding country.

SAN FRANCISCO, CAL.—The Pacific Coast office of the Westinghouse Electric and Manufacturing Company reports the sale of the following apparatus during the month: 1 2½ horse-power 500-volt multipolar motor; 1 7½ horse-power 500-volt multipolar motor.

FLAGSTAFF, ARIZ.—Yuma capitalists will soon begin the erection of a large smelting plant at Castle Dome for the reduction of the lead and silver ores from the mines near that place. Electricity for the works will be furnished by water power taken from the great Yuma irrigating canal.

SALT LAKE CITY, UTAH.—R. M. Jones, Manager of the Big Cottonwood Power Company, has returned from the East after having ordered a complete transmission plant for the company. Mr. Jones will now devote his time to the management of the company during period of installation.

SONORA, CAL.—It is reported that local capitalists, believed to be the Sonora Electric Light Company, intend to build a dam across the north fork of the Tuolumne river, near Duck Wall Canyon, about five miles from Somersville, for the purpose of developing additional electric power.

VICTORIA, B. C.—F. S. Barnard, who has just returned from London, says that he has succeeded in obtaining capital to the extent of $500,000, for the purpose of developing the water power of Seymour Creek, and thereby generating electricity for electric lighting and electric railways in Vancouver, New Westminster and vicinity.

LOS ANGELES, CAL.—The San Gabriel Power Company proposes to take the entire flow of the San Gabriel river out of its bed eight miles above the mouth of the Azuza Canyon, and by conveying it through a tunnel to develop a fall of 400 feet. This tunnel will be about 1000 feet long and is already half completed. The promoters are W. C. Kerckhoff, A. Haas and others of this city.——A recent survey of the proposed transmission line for the Kern River and Los Angeles Electric Company shows that its length is under 110 miles. Between the reservoir on Salmon creek and Kern river, a distance of eight and a half miles, there is a fall of about 5,100 feet, there being one waterfall of 2,000 feet.——W. N. Myers has purchased a 400-horse-power electric plant to furnish power to pump the wells in the oil fields.

SAN FRANCISCO, CAL.—The Pacific Transmission Company has been incorporated for the purpose of generating electric power from the refuse coal at the Corral Hollow coal mines in Alameda and San Joaquin counties, for transmission to the cities of Stockton, San Jose and elsewhere. Eight hundred thousand dollars have been invested in developing the mines, and it is stated that the initial plant will generate 5,400 horse-power. Messrs. James and John Treadwell and others, among whom are representatives of the General Electric Company, are the incorporators. ——The Merced Falls Electric Power and Manufacturing Company has been incorporated by J. P. Flemming and others, with $1,000,000 capital.——The Westinghouse Electric and Manufacturing Company reports the sale of one 45 kw. two-phase and one 60 kw. single phase plants.

FRESNO, CAL.—The contract filed by the San Joaquin Electric Company, with the County Recorder for the purchase of electrical apparatus from the General Electric Company, describes technically the machinery and supplies called for, the cost being $113,500. About 400 miles of copper wire must be furnished, together with 1000 incandescent lamps, 160 arc lamps, and the various machinery heretofore described. The San Joaquin Company has accepted the county franchise with the understanding that the entire work is to be completed within one year. About 150 men are at work on the dams and ditches of the company. These are now about completed, and the work of grading for the pipe line and power house site is in progress. The poles for the thirty-five mile transmission have been ordered, and work on the pole line will be commenced by October 15th. The initial capacity will be 1040 kilowatts in three units; 4100 feet of pipe line must be laid, which will develop water power under 1410 foot head.

GRASS VALLEY, CAL.—The contract for stringing the wire for the Nevada County Electric Power Company has been awarded to the Electrical Construction & Repair Company, of San Francisco. The basis of the contract is the stringing of seventy-two miles of bare copper wire of various sizes over pole lines already erected, and at the top of the pole a circuit of No. 8 iron wire, which is broken and grounded at every other pole. The pole line starts out from the power house at a grade of forty per cent. About 30,000 feet of lumber is being received daily, and is being placed in the flume of the Nevada County Electric Power Company. This flume will be 18,400 feet in length, and is now about two-thirds finished, and will be entirely completed by the middle of October. Only a few weeks more work will be required on the dam, which is being constructed of heavy granite logs and concrete. A new road has been built to allow the hauling of dynamos, water-wheels and lumber to the site of the power house, and no delay is occurring in any branch of the work.

ILLUMINATION.

FORT JONES, CAL.—It is expected that an electric light plant will be installed here.

YUMA, ARIZ.—An electric light and pumping plant is soon to be placed in the prison.

LONG BEACH, CAL.—The Long Beach Electric Light Company will soon extend its service to San Pedro.

PHŒNIX, ARIZ.—A 250 light plant is being installed in the insane asylum, together with a pumping outfit.

SANTA BARBARA, CAL.—Negotiations are nearly consummated for a 1000-light generator for the town of Santa Maria.

PRESCOTT, ARIZ.—Arrangements are about completed for the installation of another electric light plant of 2000-light capacity.

SANTA CRUZ, CAL.—C. Osborn has been appointed to succeed C. E. Lilly as superintendent of the Electric Light and Power Company.

PASADENA, CAL.—Bids and specifications have been received by the Electric Light and Power Company for an additional 150-horse-power boiler.

BENICIA, CAL.—The old engine and dynamos of the Napa Electric Light Works have been moved to Benicia, where they will be used to furnish light for that city.

WOODBURN, OR.—Davis Brothers of Silverton are canvassing this place with the idea of securing sufficient business to warrant the installation of an electric lighting plant.

NAPA, CAL.—The electric lighting franchise recently secured by L. A. Grothwell has been assigned to a new company known as the Napa and St. Helena Electric Company.

SALINAS, CAL.—The Salinas Gas and Water Company has accepted the proposition of the Common Council for seven additional street arc lights, at $7.50 each, for fifteen months, and will place same immediately.

GRASS VALLEY, CAL.—The North Star Mining Company has installed an incandescent lighting plant, consisting of a 100-light dyamo of the Electrical Engineering Company, operated from a 10-horse-power Girard water wheel.

ST. HELENA, CAL —The General Electric Company will install an electric lighting plant for the Napa and St. Helena Electric Light and Power Company, and are now at work laying out a complete system of wiring for the town.

SONORA, CAL.—Grant & Bannister are to install a 500-horse-power electric light and power plant, to be completed by February 15, 1896. Wires will be run through Sonora, Columbia, Jamestown and other towns for lighting purposes.

WATTSBURG, WASH.—J. G. Stevens has secured a franchise to erect an electric light plant, and will begin work at once. Power will be furnished from Washington Mills temporarily, but eventually Mr. Stevens will take out a mill-race of his own.

TACOMA, WASH.—The Board of Public Works intend to increase the electric lighting plant by the addition of a new 125-horse-power boiler, a 2000-light alternating generator and a 250-horse-power engine, the generator and engine to be second-hand, if the same can be obtained. The plant is now supplying 580 arcs and over 3000 incandescents.

ANACONDA, MONT.—The Anaconda Electric Light and Power Company are building a new power house, which will be fitted out with a new outfit of water wheels, dynamos, etc. Four new Leffel turbine wheels and a Cascade wheel will be used, directly connected to the dynamos. A Brush generator will furnish arc lights, and a Westinghouse the incandescents. A storage battery will be placed in Carroll.

SAN LEANDRO, CAL.—An ordinance stating the necessity of putting in an electric light plant has been referred to the Ordinance Committee, and as the price of such a plant would be too great for the city funds, it has been proposed that bonds be issued. A bid of $2,383.60 has been received from the Best Manufacturing Company for furnishing power for an electric light plant, and for installing the electric plant the following bids: California Electrical Works, $4,458.20; A. C. Rowlands, $7,183.

SAN FRANCISCO, CAL.—It is reported that the recent Eastern trip of J. B. Stetson, President of the North Pacific Coast Railroad and also of the Edison Light and Power Company, was in connection with electric light matters. It is understood that Mr. Stetson's object is to meet the threatened competition of the San Francisco Gas Light Company by engaging in the gas business, and Professor Stewart is authority for the statement that the present plant of the gas light company, which cost $12,000,000, can be duplicated for $3,000,000. It is rumored that the electric company has under consideration the adoption of the professor's ideas and intends to manufacture gas at rates lower than it has ever been believed possible to make it.——The Merchants' Association is advocating the lighting of Market street with arc lamps, and the daily papers are urging the Park Commissioners to install an electric plant for lighting Golden Gate Park.——W. J. O'Connor has relinquished the agency for the Sunbeam Incandescent Lamp Company and now holds the Pacific Coast selling agency of the Buckeye Lamp under the California Electrical Works.

TRANSPORTATION.

PASADENA, CAL.—T. S. C. Lowe has been granted a franchise for an electric railway connecting with the Pasadena street car system and the mountain railway at Altadena.

ST. ANTHONY, IDAHO.—Engineers are at work surveying for a road to be built from this place to the nearest point on the Utah & Northern, a distance of about twenty-seven miles.

SAN DIEGO, CAL.—The General Electric Company has secured the contract for equipping the San Diego Cable Company's road with electricity. The contract iucludes dynamos, cars, trolleys and all other appliances.

REDLANDS, CAL.—E. G. Judson, one of the committee of the proposed electric street railway, has figured the cost of equipment at about $8000 per mile. The length is five to six and a half miles, the cost being $40,000 to $65,000.

SAN JOSE CAL.—Messrs. L. M. Hale and J. P. Pfetch have submitted a proposition to the Board of Trade to build a first-class road between San Jose and Saratoga and Congress Springs. A committee of the Board of Trade endorses the proposition, and urges that the property owners, in vicinity of the proposed road, subscribe $50,000, but no money will be paid until the road is in satisfactory operation.

HAYWARDS, CAL.—Surveys have been finished on the San Leandro and Haywards branch of the proposed electric road from Oakland to Livermore. Surveyors are also at work on other portions of the road, but no route has been accepted.

PHŒNIX, ARIZ.—Lincoln Parlor has been granted a fifty-year franchise for a standard gauge railroad to be operated by horse, electric or steam power on Van Buren street and Woodland avenue, from the center of Seventh avenue westward to the city limit.

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Electric Bailway Company is now at work on its road to extend from State street along Haley street to the County Hospital, and expects to extend the road through the principal streets in the near future.

SEATTLE, WASH.—A new power-house is being built for the Seattle Consolidated Street Railway Company, new cars have been ordered, and rails for Second street were shipped from Chicago. The company will spend over $100,000.——The Seattle and Tacoma Electric Railway scheme is being revived.

SALT LAKE, UTAH.—O. B. Hardy and W. J. Moorhead have applied for a franchise to build an electric plant for furnishing light and heat, and maintaining and operating electric railroads in the West Mountain mining district. They agree to light the jail at Bingham, during the life of the franchise, free of cost to Salt Lake County.

OAKLAND, CAL.—The General Electric Company have received the contract to equip the Piedmont division of the Mountain View & Piedmont Railroad Company with electricity. Seven new cars will be run through from Piedmont to Seventh and Washington street. The cable track to Piedmont will be kept in repair, and the cable will probably be operated Sunday afternoons, when it is necessary to carry more passengers than the electric cars will accommodate.——The Haywards Electric Railway Company ran special trains from this city to Haywards during the recent bicycle road races. These trains had the right of way, and, as the track runs along the road used as the race course, hundreds of people took advantage of the opportunity offered to keep pace with the racers.——The Oakland Street Railway Company submits applicants for positions to a rigid written examination.

SAN FRANCISCO, CAL.—The San Francisco and San Mateo Electric Railway Company has applied for a franchise to extend its Park branch from the present terminus at Stanyan and Waller streets, along Stanyan to Sullivan, to J, to Ninth avenue, and thence through the old San Miguel Rancho to Ingleside.——C. Stein, the tie-plate expert of the Q. & C. Co., of Chicago, who was at the Palace Hotel, is superintending the placing of several millions of tie-plates on various electric and steam roads throughout the Coast, among which are the Los Angeles Consolidated Electric Railway Company, the Southern Pacific, the San Francisco and San Joaquin Valley, and the San Francisco and North Pacific Railway Company. Mr. Stein is now in Mexico.——The Abner Doble Company are installing fifteen double 25-horse-power Walker equipments on the 38-foot combination cars of the Sutro Railroad Company, the installation aggregating 1500 horse-power. These cars are each guaranteed to haul a 28-foot trailer up a 11 per cent. grade at five miles per hour, when loaded with 180 passengers on the car and 150 passengers on the trailer. The Westinghouse E. & M. Co. has sold 48 horse-power in small motors to the Sutro Railroad Co.

LOS ANGELES, CAL.—The Main Street Railway has been purchased by a San Francisco syndicate, which proposes to equip the entire road with electricity.——The Los Angeles Traction Company is extending the terminus of its road to University station, as follows: From Freeman street, the present terminus, along Hoover street, Forrester avenue and Vermont avenue to the University station. Other extensions are projected in the near future.——The Los Angeles Electric Railway Company has sold its bonds, and is now ready to commence work on the Altadena extension.——Prof. Lowe has applied for a franchise to operate an electric railroad from the corner of Raymond and California streets to Broadway. The road will be built without delay.——R. F. Clark and associates have been granted an electric railway franchise over various streets commencing with the intersection of Main, Spring and Temple streets, and terminating at the intersection of Mission Road and the city limits. Another franchise has been granted to T. C. Paxton for an electric road to commence at the intersection of Hill and Eighth streets, running thence along Hill to Sixteenth, to Figueros, to Sixteenth, to Georgia Bell street.——By January 1st, 1896, there will be an electric street car line starting from the corner of Fourth and Spring streets to run through Hollenbeck Park.— The Pasadena and Pacific Electric Railway Company has awarded the contract for the trolley and feeder circuits for its line from this city to Santa Monica to the John A. Roebling's Sons Company. The length of the road is twenty-two miles.

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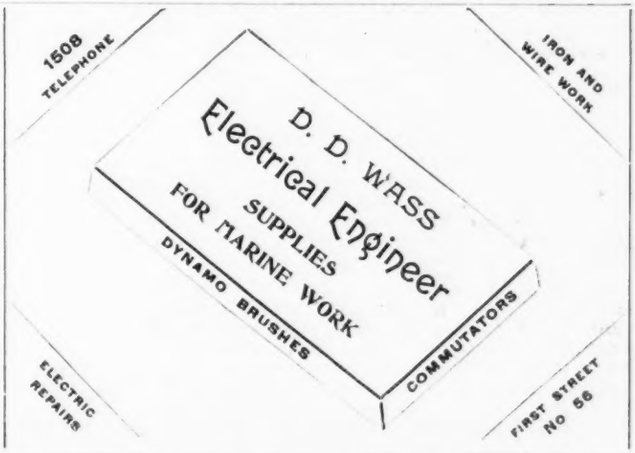

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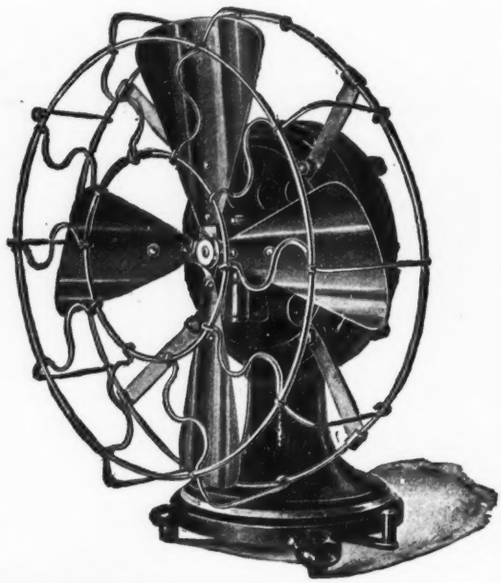

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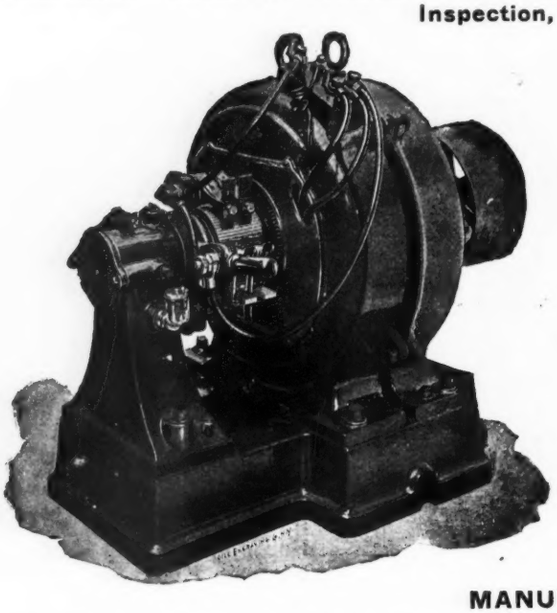

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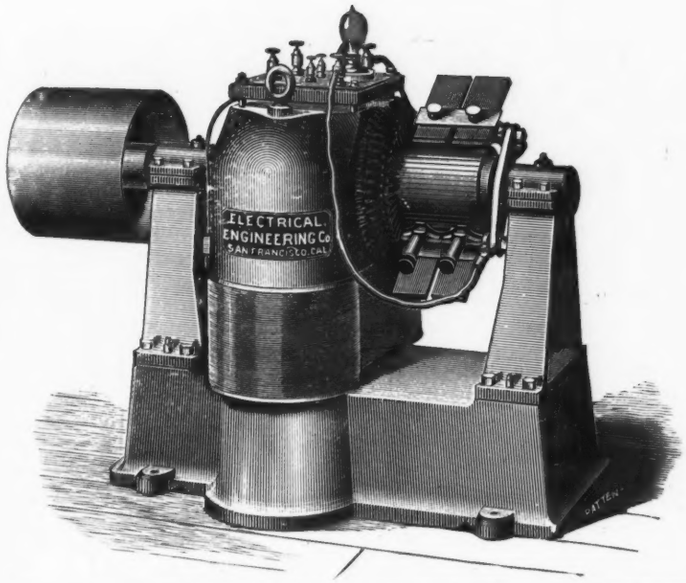

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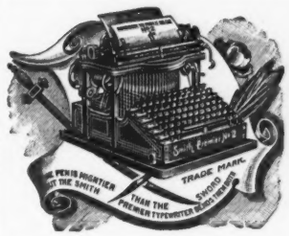

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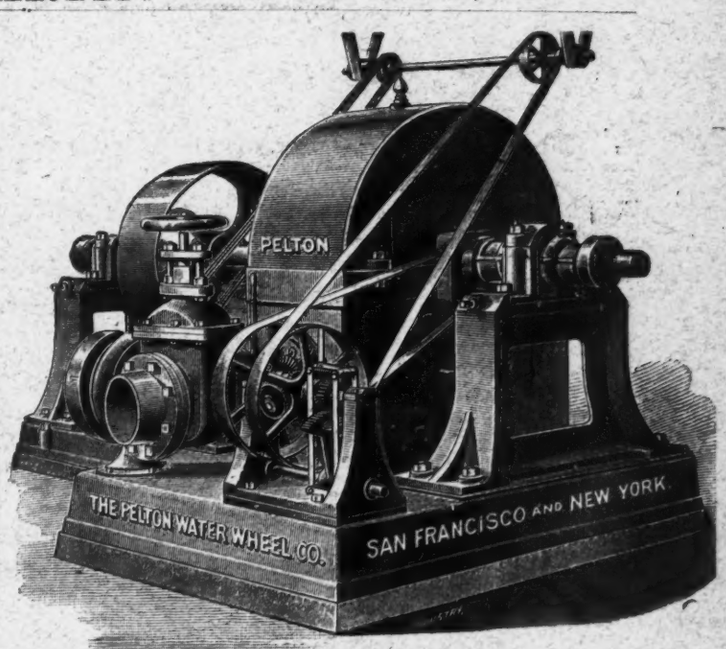

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